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PICKS and SHOVELS

By O. E. POTTER

WPA—Men Working?

Harry Hopkins may be right when he says "They'd rather work" but apparently fate is often against them, writes a correspondent to *Colliers* Magazine.

"Take for example, the contractor who was anxious to get his culverts poured before bad weather set in. He was quite put out one day when his crew didn't show up. But later on he learned that since the road at the other end of the gravel was muddy, the boys having come that way to work flipped a coin to see whether they ought to get their shoes soiled. It came up heads. So what could the poor boys do?"

What indeed?

Is It a Man's World?

The invasion by women of the masculine domain of the construction industry has been postponed far longer than in most fields of activity. Word comes to us, however, of feminine pioneers in the contracting business. Not long ago we heard of a young woman in the Middle West, the daughter of a contractor, who went into business for herself and successfully completed the construction of a sewage treatment plant, despite the obstacles which her invasion of a "man's world" naturally brought.

Still more recently, our attention has been called to the only woman contractor on the job at Grand Coulee—Mrs. C. M. Payne, Sr., owner of the C. M. Payne Contract Trucking Co., which is operating a large fleet of trucks on the biggest dam construction job ever undertaken. Mrs. Payne, who

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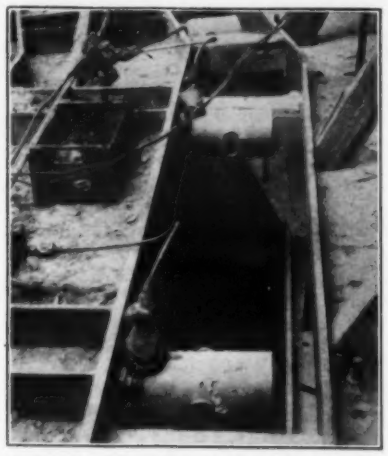


Hydraulic Jacks Mounted on a Steel Segment Ring to Hold the Steel Sheeting Against the Pressure of Quicksand.

WPA Road Work in a Tenn. County

Gibson County Engineer Urges Ten-Year Program to Insure Sufficient Improvement of All Rural Roads

By J. A. HADLEY,
County Engineer, Trenton, Tenn.

WHEN the President in his message to Congress asked for the $4,800,000,000 appropriation for Federal work relief, the Tennessee County Highway Association in conjunction with the State Planning Board outlined a $10,000,000,000 rural road improvement program. At the same time we urged our Senators and Congressmen to aid in securing a just portion of this fund.

As soon as the state set-up for Work Progress Administration was formed, the Administrator, Col. Harry S. Berry, announced that he was asking for $10,000,000,000 for a farm-to-market road program for Tennessee.

The requirements set out by Col. Berry were that the counties turn their 2-cent gas tax over to the State Highway Department so that the State Highway Department would have full charge of the entire county road system of the state. Naturally, the county highway organizations objected to this as this requirement was not made anywhere except in Tennessee. After some controversy, a program was promulgated in which most counties have joined. That is, the counties have to match the Federal fund on a 30 to 70 basis and allow the State Highway Department to sponsor the program with the County Highway Commission designating the roads to be improved and handling the work.

Program of Gibson County

Gibson County is an average rural

(Continued on page 34)

Unique Remedy for Leaning Bridge Pier Near Grand Coulee

By HENRY W. YOUNG

(Photos on page 40)

Straightening of Pier No. 2 of Bridge over Columbia by J. P. Pomeroy Co. First Job of Its Kind

DOWNSTREAM from Grand Coulee Dam approximately half a mile is the Columbia River Highway Bridge, a standard cantilever structure, 550 feet long between piers, completed late in 1935 for the Bureau of Reclamation, U. S. Department of the Interior. In connection with this bridge, a piece of construction work is now being done by the contractor, J. H. Pomeroy, Inc., San Francisco, that in point of novelty will interest contractors and engineers everywhere. Taken by itself, the size of the job is enough to be impressive. But being literally in the shadow of Grand Coulee's immensity, it does not stand out as it should in the estimation of the casual visitor.

The job is the straightening and strengthening of Pier No. 2 on the east side of the river. Just before the completion of the bridge, it was found that this pier had moved, in effect tilted, toward the river. This movement was discovered when an attempt was made to adjust the shore arm of the cantilever to the land pier. Then it was found that Pier No. 2, 148 feet in height from bed rock to column cap, had tipped inward 9 inches at the top, in a direction along the line of the axis of the bridge.

It was still possible to effect a union of the members and complete the bridge by lengthening some of the expansion slots. But it was obvious that the pier must not only be straightened but also strengthened, and that before the coming of high water in May or June, 1936. The Bureau at once relieved the Pomeroy company of the responsibility of completing the final details of the bridge and contracted with them to apply a remedy to the situation by putting the pier back into place and reinforcing it against further movement. The fault had been in no way the contractor's but had been caused by an extensive slip of the east side bank, bringing such pressure to bear on the land side of the pier as to start tipping it inward.

Plan of Action

Preliminary clearing and leveling of the site was done late in December and actual work started about January 1. The general plan was to drive a circle of interlocking steel sheet piling down to bed rock, surrounding the pier but on a center 10 feet nearer the stream than the center of the pier, and excavating as fast as the piling was driven. It was planned to support the piling on the inside by a series of rings—inside "hoops," so to speak. These rings were to be composed of heavy steel I-beams, cut in short lengths to form chords of the circle. The segments of the ring were to be placed inside the piling, forced out into place against the latter by hydraulic jacks and then welded to form a solid ring, holding the piling firmly against the pressure of the outside material.

The diameter of the circle was to be 110 feet, and the caisson formed by the piling would be 80 feet in height from bed rock. The rings were to be 18 in number, equally spaced, and each ring was to be made up of 26 segments, with two jacks to each segment.

It was assumed that after the piling had been driven and the excavation completed to bed rock, the pier would come back into place of its own accord, which was exactly what happened, the crack under the edge next to the shore was squeezed shut and the pier and its column came back into the vertical.

The plan then contemplated the placing of a reinforcing slab of concrete completely around the pier from bed rock to a point well above the junction of the pier and upper column. This slab was designed to be rectangular in cross section, 50 x 59 feet at the top and 110 x 59 feet at the bottom, with the heel 25 feet from the old center line and the toe 75 feet, taking up the full diameter of the caisson at the bottom. When poured, this slab of con-

(Continued on page 37)

There Are Thousands of Bridges Such As This Michigan Span Which When Strengthened Will Meet the Increasing Demands of Present-Day Traffic. See Page 35.

A Typical Bridge for Feeder Road

Nebraska Road Department Uses Structures of Treated Timber Piling with Concrete Cap and Concrete Slab Span

By H. W. CULWELL, Project Engineer, Department of Roads and Irrigation

(Photo on page 40)

A BRIDGE typical of the structures being built on farm-to-market feeder roads by the Nebraska Department of Roads and Irrigation was completed on Project NRS 379 in Richardson County, near Stella, Nebraska, early in 1935. This structure is an overflow bridge for the Muddy River which during heavy rains frequently overflows its banks. The bridge has two 16-foot concrete slab spans of 24-foot roadway with 23 feet clear roadway, concrete caps and treated timber piling. The wings and backing are also of treated timber.

The two abutments have five piles exclusive of the wing piling, while the bent contains six piles. No difficulty was experienced in driving these piles as no hard rock was encountered. A 2,000-pound drop hammer was used. Piles 30 feet in length were used for both the west and east abutments and bearings varying from 9.1 to 13.1 tons were obtained, the average being 11.05 tons for the 10 piles. For the bent the six piles were each 35 feet long; the bearings varied from 10.9 tons to 14.4 tons with an average of 12.9 tons.

Concrete Caps

Concrete caps, 2 feet square, were placed on the piling which extended 6

(Continued on page 18)

Subway Approaches for Electric Railway on Delaware Bridge

An Electric Crane Excavates in Close Quarters in Philadelphia

Contractors for Subway in Philadelphia and Camden Found Variety of Foundation Problems

By C. C. HARRINGTON

(Photos on page 40)

THE building of a high-speed electric line across the Delaware River Bridge connecting Philadelphia and Camden required the construction of a section of subway at each end of the bridge. In Philadelphia, this meant the construction of a subway connecting link between the bridge approach and the existing Eighth Street terminal of the Philadelphia subway system. In Camden it was necessary to construct the city's first subway system, joining the bridge approach with the business center, and providing two underground stations.

The total cost of the electrification and subway work is estimated at $12,000,000. This expenditure has been financed by the Delaware River Joint Commission of Pennsylvania and New Jersey, which operates the bridge, through the sale of bonds to private bankers, and a PWA grant of $1,900,000. The line is to be a double track system 2.68 miles from terminal to terminal. Provision on the bridge structure was made for such a line when the bridge was built, and required only the laying of rails and decking the approaches.

Traffic estimates anticipate a week-day total of 66,000 passengers, with a maximum hourly movement in one direction of 6,600 passengers. When the project is completed, facilities will be adequate to handle approximately 17,000 persons per hour. Running time between terminals will be 9 minutes or less.

The construction of the two subways was done under three contracts. Contract No. 1 for the entire Philadelphia side was awarded to Builders, Inc., and included besides 1,140 feet of subway and one station an underground passage to carry Fifth Street below the level of the tracks leading to the bridge approach.

About half of the subway work on Contract No. 1 was done under a small park, Franklin Square, free from the proximity of large buildings. The contractor used open excavation, following the excavation with horizontal timber sheeting set in H-columns. Two Koehring gas shovels and two Bucyrus-Erie electric shovels did most of this work, the spoil being removed by trucks, mostly Macks. No difficulty was experienced with water or rock.

The Fifth Street underpass was a major part of this contract. It was built

(Continued on page 13)

Advertising Signs Cause Many Highway Accidents

No appreciable decrease in highway accidents can be brought about until all the fundamental causes of the accidents become known. The State Highway Department of Mississippi deems it a function of the department to study the causes of highway accidents and seek to prevent them, just as it is the function of the department to construct and maintain roads, reports *Mississippi Highways.*

According to Sam J. Dalton, Chief of the Maintenance Department, it is just as necessary to make the roads of Mississippi safe as it is to make them smooth. Unless safety keeps pace with the improvement of highways, accidents will continue to increase.

The diversion of the attention of drivers on the highway is one of the many causes of accidents, in Mr. Dalton's opinion, and is a cause which should be removed by the passage of more stringent laws regarding advertising signs along the roads. The very fact that such a large amount of money is spent each year for roadside advertising is conclusive evidence that these signs are read by those traveling by and it is logical to assume that the drivers of cars are among the readers.

An advertising sign need not be a large one to divert a driver's attention. In fact, the small not-easy-to-read sign is more likely to cause trouble because of a driver's effort to read the sign, during which time he may fail to see an obstruction in the road, a person, another car or a curve.

This important matter should, according to Mr. Dalton, be recognized by the legislatures and the present laws amended so that the highways to be improved and constructed under the present program may be as safe as possible.

Old Tar Penetration Surfaced with Hot-Mix

Warren Bros. Roads Co. Resurfaced Mass. Road After Penetration for Widening and Leveling

MASSACHUSETTS makes an unusual excursion into Connecticut where State Route 10, the College Highway from Northampton, crosses the northern boundary of the Nutmeg State and heads toward New Haven. The story of this Southwick Jog was told in "Picks & Shovels" in our February issue under "Boundaries and Blunders."

A paving project, NRH 73, 6.874 miles in length, was completed recently on this route by Warren Bros. Roads Co., in Southwick, Mass., from the Westfield line to the Connecticut state line.

This contract called for the widening and resurfacing of an old tar penetration macadam highway built in 1922 which was 18 feet wide with a stone base from 8 to 12 inches thick. The tar penetration was a 2-course surface on this base. The 1935 contract required the placing of an 8 to 12-inch new gravel base where the road was widened, a 3-inch bottom course of 2-inch and 1-inch stone mixed, bound with sand and then a 1-inch course of 1-inch stone feathered into the one-quarter point of the road and bound with 1 gallon of asphalt per square yard. The excavation for the 3-foot widening trench was handled with a ¾-yard P & H gas shovel with hand trimming.

The wedge and bottom course of penetration macadam exceeded the preliminary estimate by 1,258 tons of crushed stone and 20,800 gallons of asphalt, as some of this rock was lost in rolling into the soft gravel base which had not been rolled to complete compaction as it was too narrow for the use of a standard roller. The feathering in of the wedge course with penetration macadam saved about 159 tons of hot-mix top.

Crushed stone for the wedge and bottom course was furnished by the Connecticut Quarries Co., at Granby, Conn., a 2-mile dead haul from the south end of the job. The Binder C asphalt for penetration was furnished and applied by the Standard Oil Co. of New York.

The wedge course of rock was spread with a Burch stone spreader which worked remarkably well in spreading a thicker layer of rock at the outer edge of the old 4½-inch crowned tar macadam and feathering it at the one-quarter point.

Hot-Mix Plant

The hot-mix plant, a set-up of Warren Bros. consisting of feeder bucket conveyors, dual driers, hot material elevator, screens, separate weigh boxes for aggregate and asphalt, and asphalt tanks, was located at the Connecticut Quarries Co. plant at Granby. The specified temperature for the mix was from 170 to 275 degrees in order to insure proper workability when delivered to the job but the actual temperature was around 275 degrees, due to a heavy fuel oil used in the driers.

A typical batch for the hot-mix had the following composition: stone, ¾-inch to 1-inch, 1,200 pounds; stone, ½-inch, 485 pounds; fines, 615 pounds; asphalt, 107 pounds; Warcolite solution, ½-gallon, making a total batch of 2,411 pounds.

The scatter coat to furnish a non-skid surface for the pavement was made up of 2,200 pounds of ½-inch stone chips, 55 pounds of asphalt and ½-gallon of Warcolite solution.

Placing the Hot-Mix

After 55 seconds mixing in the pug mill, the hot batches were dumped into 5-ton trucks and hauled to the job where they were dumped into the hopper of an Adnun mechanical spreader which was followed up by two rakers and a shovel man to take care of the material along the edge. The 2-inch hot-mix top was rolled with an 8-ton Buffalo-Springfield tandem gas roller and a 12-ton steam roller of the same make. The rolls were wiped with fuel oil to prevent sticking to the newly spread hot-mix.

This contract which was started June 3, 1935, had a time limit of September 28, 1935. The contractor was able to spread and roll 3,000 linear feet on one-half the road width in two 6-hour shifts. The hot-mix weighed about 240 pounds per square yard 2 inches deep.

Personnel

This contract for the paving of 6.874 miles of 24-foot pavement, including the widening of the original roadway, was awarded to Warren Bros. Roads Co., Cambridge, Mass., for $119,333.30. The contract was in charge of Thomas Sandford, Superintendent for the contractor. William K. Johnson was Resident Engineer for the Massachusetts Department of Public Works.

C. & E. M. Photo

Set Up at a Quarry in the Nutmeg State, This Plant Furnished Hot-Mix for a Bay State Contract

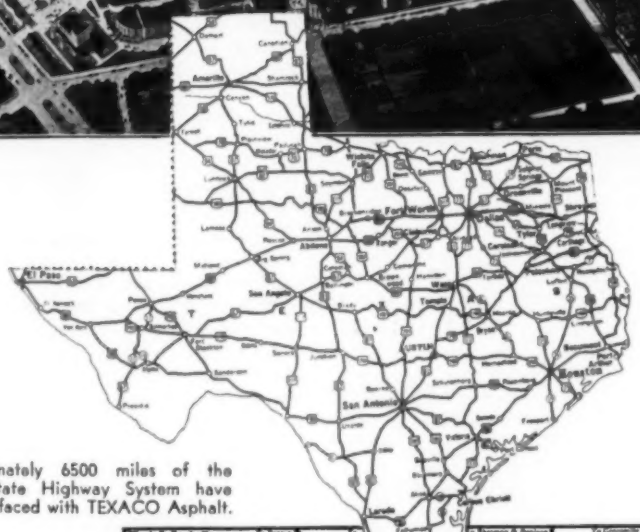
Millions of Americans plan to visit the TEXAS CENTENNIAL

The Texas Centennial Exposition, the result of ten years of planning, represents an outlay of more than $25,000,000.

Time, effort, expense. None of these has been spared in the staging of Texas' mammoth Centennial celebration. Everything conceivable has been done to attract visitors and to make their stay memorable.

A great network of modern highways reaches into every corner of the "Lone Star" State, making the many points of interest easily accessible to the visiting motorist.

Approximately 6500 miles of the Texas State Highway System, sections of most of the highways leading into Dallas County, portions of practically all the Dallas streets leading to the Centennial Grounds, and a substantial part of the paving on the Grounds proper have been constructed with TEXACO ASPHALT.



Approximately 6500 miles of the Texas State Highway System have been surfaced with TEXACO Asphalt.

Traffic entering Dallas County, Texas, on any of the following highways, rides on TEXACO Asphalt.

From north, State Hgy. No. 6 (U. S. No. 75)
From north, State Hgy. No. 14
From northeast, State Hgy. No. 1 (U. S. No. 67)
From southeast, State Hgy. No. 40 (U. S. No. 175)
From south, State Hgy. No. 6 (U. S. No. 77)
From southwest, State Hgy. No. 68 (U. S. No. 67)
From west, State Hgy. No. 1 (U. S. No. 80)

TEXACO asphalt

THE TEXAS COMPANY, Asphalt Sales Department
135 East 42nd St., New York City

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Cleveland
Kansas City
Houston
Dallas

Buffalo
Philadelphia
Boston
Richmond
Jacksonville

Texaco Asphaltic Concrete pavement on a section of State Highway No. 1 in Dallas County, Texas.

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This Safety Business

A bill was recently introduced in the House of Representatives at Washington to make unlawful the interstate shipment of cars of less than 8-passenger capacity which could travel at more than 60 miles per hour under their own power. Cars of larger passenger capacity would be restricted to maximum speeds of 40 miles per hour. This impresses us as being like the convicted man in the death house who hung himself to save his life. Limitation of speeds of motor vehicles, by itself, will have little effect in reducing the toll of traffic accidents. The situation has reached the point today where dozens of different contributing factors must be considered. Let us name a few of them.

As a gesture at economy, city and village officials have traffic signals placed at caution during the night instead of permitting them to operate throughout the 24 hours. Too many drivers do not even hesitate at the caution light but assume that whatever road they are driving is a main thoroughfare and that they have the right-of-way. The result is numberless collisions.

Contributing to this traffic Juggernaut are the right angle turns on main routes. Many of these are being eliminated but there are still too many of these accident breeders to excuse state and county highway departments.

There are still too many narrow bituminous roads with raveled edges so that when a car tries to pass a bus, the right-hand wheels slip into holes and momentarily cause the driver to lose control of the car, resulting in accidents.

Concrete roads come in for their share of trouble because of poorly maintained shoulders which are not kept up to the level of the pavement. This results, particularly with the higher pressure tires, in the driver being unable to get the car back on the road immediately and too frequently causes crashes.

Motorists should demand center lines painted on all roads with broken lines where it is permissible to cross the center to pass a car. We object strenuously to the system of painting a continuous line for mile after mile on a straight level highway just as a means of permitting the local motorcycle policeman to pick up a few extra dollars. Center lines should be painted on every curve and over the crest of every hill to keep the wanton driver in line and prevent crashes.

Warning signs on curves should be uniform and should record the safe speed in legible figures illuminated with reflector buttons at night. Some states differentiate between a "curve" and a "turn." This is a good idea but unfortunately the word "curve" appears on too many right-angle turns, causing more accidents.

The three-lane highway is responsible for a large share of accidents because of the many cases of side swiping where cars when they meet in the center lane try to dodge back into the outer lanes.

Accident records on the New Brunswick Turnpike, U. S. Route 1 in New Jersey, have shown definitely that even the four-lane highway is a prolific source of fatal accidents. New Jersey is spending hundreds of thousands of dollars to move part of this highway laterally in order to put in the much needed boulevard strip in the center with two lanes of traffic on either side. The next step should be to plant low shrubbery on the boulevard strips so that there will be no chance of accidents caused by headlight glare.

Then something must be done to keep the pedestrian off the road. *Roads and Road Construction*, an English contemporary, in its February, 1936, issue, shows a finishing machine developed especially for concrete cycle paths. The bicycle craze has not become sufficiently great in this country to cause a united demand by Cycling Clubs for bicycle paths, but every man, woman and child in this country is a pedestrian more than he is a rider in a motor vehicle and sidewalks must be constructed alongside all heavily-traveled highways adjacent to populous centers to reduce the tremendous annual death rate among pedestrians.

The solution of the accident death rate is not in governors or cars, not entirely in wider, straighter roads nor in sidewalks, but rests largely in comprehensive safety education campaigns which should be carried on in all secondary schools with supplementary junior campaigns in lower grades. The high school boy or girl is already an automobile driver in many states and in the others he is next year's potential driver. Educate him to the hazards of motor driving and the results of carelessness before he gets behind the wheel and then determine his ability to drive by means of adequate tests before he is issued a license permitting him to take a machine which can be a deadly weapon out on the public highway.

Mississippi Highways recently printed this potent thought on traffic accidents, "It always happens when one driver is in a big car and the other in a reverie."

There's Teeth in the License Law in California

Abram Elfand of Los Angeles ran afoul of the Contractors' License Law and ended up in jail when Rubyn Blake, also of Los Angeles, swore to a complaint charging Elfand with contracting without a license, it was reported by the Registrar of Contractors.

Justice of the Peace Marion, presiding in Belvedere court, sentenced Elfand to 30 days in the Los Angeles County jail and placed him on probation for two years. Blake, incensed at trouble over Elfand's work, reported to the court that Elfand had caused him considerable loss on the job in addition to the non-license charge, and the judge ordered Elfand to pay all labor and material bills outstanding.

Boulder Dam Dates That Are History

Dec. 21, 1928. Boulder Canyon Project Act, authorizing Boulder Dam, approved by President Coolidge.

June 25, 1929. Proclamation declaring Boulder Dam Project effective issued by President Hoover after six states had ratified the Colorado River compact.

Apr. 1, 1930. Contracts for sale of power from Boulder Dam power house for sufficient revenue to repay the cost of the project with 4 per cent interest in 50 years were executed with the Metropolitan Water District of Southern California, the City of Los Angeles, and the Southern California Edison Co.

May 19, 1930. Walker R. Young, Bureau of Reclamation engineer in charge of the Kittitas division of the Yakima, Wash., project, was appointed Construction Engineer of Boulder Dam.

July 3, 1930. Second deficiency bill carrying the first appropriation, $10,660,000, for construction of Boulder Dam was enacted.

July 5, 1930. The construction engineer was instructed to proceed with the preliminary work.

September 17, 1930. First spike in the 22-mile construction railroad was driven at Las Vegas, Nev.

Mar. 4, 1931. Bids were opened for construction of the dam at the Denver engineering offices of the Bureau of Reclamation. Three bids were submitted.

Mar. 11, 1931. Contract for construction of Boulder Dam and power house was let to Six Companies, Inc., San Francisco.

Sept. 17, 1931. Construction of the diversion tunnels was begun.

Oct. 3, 1931. Boulder City, permanent government camp, occupied.

May 23, 1932. Excavation of diversion tunnels completed.

Apr. 23, 1933. The Colorado River was diverted at the dam site.

June 5, 1933. Excavation for the dam was completed.

June 6, 1933. The first bucket of concrete was poured in the dam.

Jan. 7, 1934. The 1,000,000th cubic yard of concrete was placed in the dam.

Mar. 20, 1934. Set all-time record by pouring 10,642 yards of concrete in a single day.

June 6, 1934. The 2,000,000th cubic yard of concrete was poured in dam.

July 20, 1934. Peak employment reached, 5,251 men working.

Dec. 5, 1934. The 3,000,000th cubic yard of concrete was poured in dam.

Feb. 1, 1935. Gates of the diversion tunnels were closed and Lake Mead began to form.

May 29, 1935. The final bucket of concrete, a total of 3,240,871 cubic yards, was poured into Boulder Dam itself.

Sept. 30, 1935. President Roosevelt dedicated Boulder Dam.

Dec. 26, 1935. The first penstock was tested successfully.

Feb. 4, 1936. Tail-race of dam filled with water for first time.

Mar. 1, 1936. The United States accepted Boulder Dam and power house from the contractor, marking completion of actual construction two years, one month and twenty-eight days ahead of schedule. A total of approximately 4,400,000 cubic yards of concrete was poured in the dam and power house.

Generation of power will start probably in June or July. The turbines and generators are now being installed.

It is reported that plans are being made for the construction of an international highway through Turkey, a country considerably in need of improved roads, as is evidenced in the report appearing on page 25 of the December, 1935, issue of CONTRACTORS AND ENGINEERS MONTHLY.

Courtesy of This Week and J. M. Anthony

"And Another Thing We Need is a Direct Highway From Coast to Coast!"

No Heyday for Contractors Despite Federal Funds

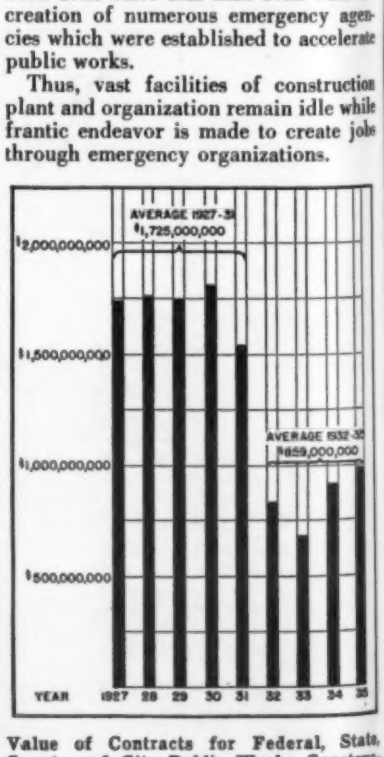
The general impression which seems to exist among the public at large that for the past several years contractors have enjoyed something of a field day as a result of public construction work is refuted by statistics charted by the Associated General Contractors of America, showing just the opposite to be true.

While immense appropriations have been made by the Federal government, including $3,300,000,000 in 1933 and $4,800,000,000 in 1935, with the much-publicized objective of reviving the heavy goods industries, the volume of public construction executed by contract is only a fraction of what contractors accounted for annually for the five-year period, 1927-1931, the Association's chart shows.

The average value of contracts for public works construction in the years 1927-31 was approximately $1,725,000,000 while the average for 1932-35 was $859,000,000, a drop of about 50 per cent.

Edward J. Harding, Managing Director of the Associated General Contractors, points out that while it has been contended on various occasions that too much time is consumed in letting contracts, it is noteworthy that permanent public agencies were able to place under contract a far greater volume of construction from 1927 to 1931 than has been done since that time even with the creation of numerous emergency agencies which were established to accelerate public works.

Thus, vast facilities of construction plant and organization remain idle while frantic endeavor is made to create jobs through emergency organizations.



Value of Contracts for Federal, State, County and City Public Works Construction as Compiled by A.G.C.

Lined Concrete Sewer —New Columbus Link

A. F. Riley, Contg. Co., a Columbus Contractor, Built Alum Creek Sewer Close to Bank of Creek

THE continuation of the extensive sewer construction program which Columbus, Ohio, has been pushing with PWA funds in the last year following up its locally-financed program of long standing, has required the solution of many difficult problems by the host of contractors who were the successful bidders. There were long wet trenches in bad ground, tunnels under heavily traveled streets and A. F. Riley Contracting Co. of Columbus had a section of the Alum Creek sewer which ran along the bank of the stream, through a small orchard of sentimentally valuable trees and under the B & O railroad.

There were 4,000 feet of 42-inch and 2,000 feet of 36-inch pipe in this section, all in 6-foot lengths. The pipe was lined with 1¼-inch vitrified plates measuring 9 x 18 inches cast in the lower half of the pipe to protect it from scour and chemical action of the sewage. The pipe on this section was all bell and spigot type.

Over the entire section the contractor used a Barnes duplex and two Jaeger 4-inch centrifugal pumps to keep the trench reasonably dry for the work. The excavation was handled with a Northwest pull shovel in open cut without sheeting and ran from 200 to as close as 12 feet to the bank of Alum Creek. At the closest point the bank was protected from high water by stone walls erected by FERA labor a year ago.

Throughout the length of the work a 15 to 10-inch underdrain of vitrified tile was laid 18 inches below the bottom of the sewer with 4 inches of crushed limestone at the sides and above the underdrain. The pipe was set with a Koehring crane, using a double line sling of steel cable looped around the pipe. This contractor used two concrete blocks for setting each pipe instead of the one usually employed on other contracts in Columbus. With a grade of 0.13 feet per 100 feet he felt that greater accuracy could be secured with the two blocks. The average depth of trench was 12 feet and the maximum 25 feet. The excavation was about 25 feet wide at the top and 8 feet wide at the bottom.

Excavation and Backfill

A Sullivan clay spader was used in the bottom of the trench for the excavation of the underdrain trench where the material was soft rock or clay. It was operated by air from a Sullivan portable compressor. Backfilling was done by hauling with two trucks from the pull shovel back to the section being covered and then pulling in the excess material piled alongside the trench with a Parsons power backfiller. An Allis-Chalmers 75 tractor was kept on the job for pulling out mired equipment and trucks that backed over the edge of the trench when hauling backfill. This has been a more common sight in all sections of the country this year than for many years past, due chiefly to the use of relief labor, many of whom may have driven automobiles over well-paved highways in their better days but to whom the handling of heavy trucks in soft ground is a new experience. They rate as truck drivers, though.

The tunnel section under the Baltimore & Ohio railroad was 225 feet long and was completed in 30 days. The tunnel was timbered with material from 6 x 6 inches to 12 x 12 inches. The pipe was run into the tunnel on industrial railway tracks set to grade.

Personnel

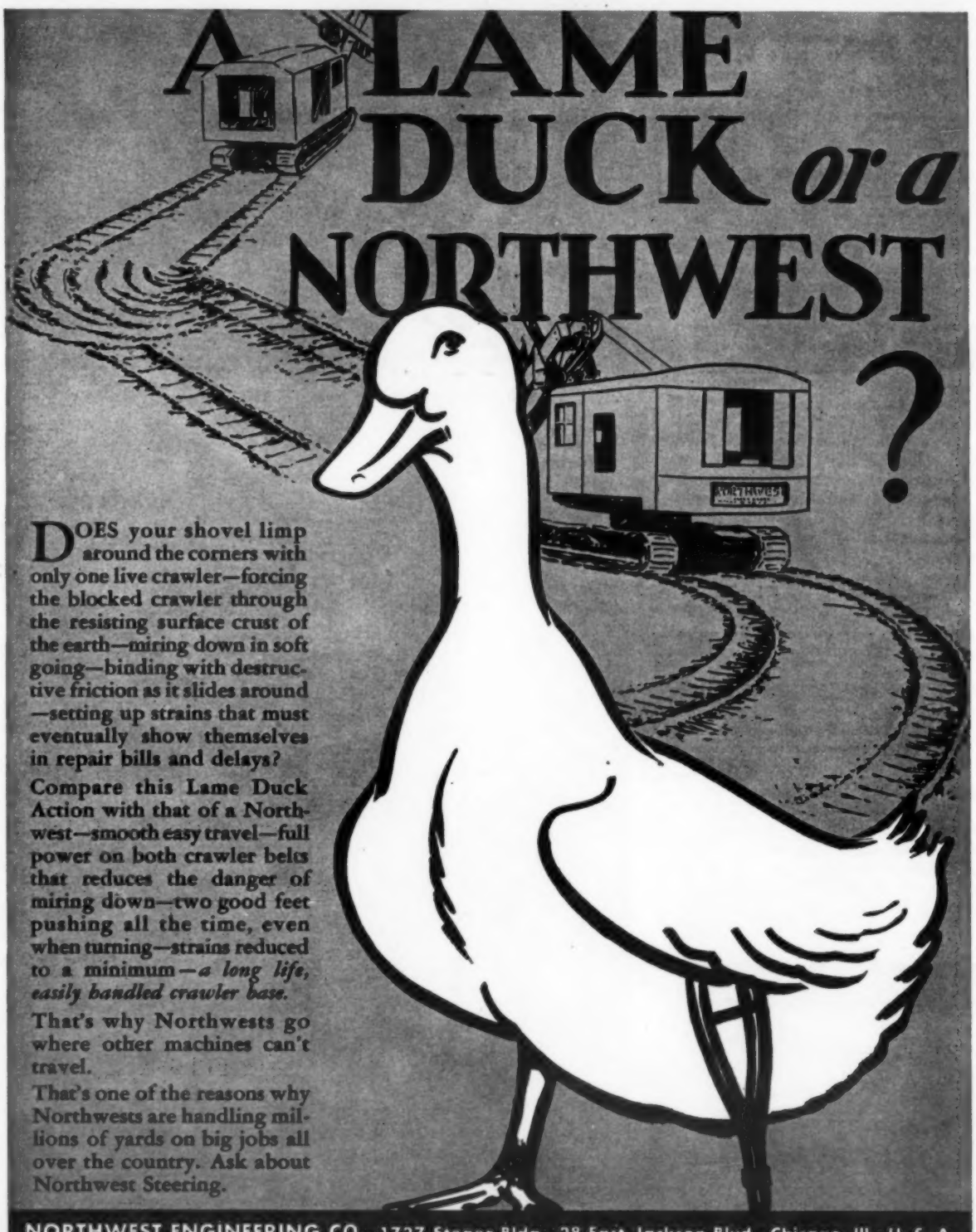
The entire direction of the work was handled by A. F. Riley personally for his own organization. For the City of Columbus the work was under the general supervision of the Division of Engineering and Construction, of which P. W. Maetzel is Chief Engineer, with O. Bonney, Sewerage Relief Engineer, in charge of the design and construction of sewers, D. T. Mitchell, Chief Field Engineer, in charge of sewer construction and L. E. Vandegrift and J. T. More, Engineers in charge of the open cut and tunnel work respectively on this contract. John H. Gregory is Consulting Engineer for the City and the PWA is represented by L. A. Boulay, State Engineer, and J. B. de Hamel, State Engineer Inspector.

C. & E. M. Photo

Setting a 6-Foot Length of 42-Inch Lined Concrete Sewer Pipe

Of the 3,250 miles in the projected Inter-American Highway, about 1,265 miles are already completed and open to all weather traffic. It is estimated that about $55,000,000 will be necessary to bring the remainder of the entire route up to a similar standard.

—*U. S. Bureau of Public Roads*


A LAME DUCK or a NORTHWEST ?
DOES your shovel limp around the corners with only one live crawler—forcing the blocked crawler through the resisting surface crust of the earth—miring down in soft going—binding with destructive friction as it slides around—setting up strains that must eventually show themselves in repair bills and delays?
Compare this Lame Duck Action with that of a Northwest—smooth easy travel—full power on both crawler belts that reduces the danger of miring down—two good feet pushing all the time, even when turning—strains reduced to a minimum—a long life, easily handled crawler base.
That's why Northwests go where other machines can't travel.
That's one of the reasons why Northwests are handling millions of yards on big jobs all over the country. Ask about Northwest Steering.
NORTHWEST ENGINEERING CO., 1727 Steger Bldg., 28 East Jackson Blvd., Chicago, Ill., U. S. A.
SHOVELS, CRANES
DRAGLINES
PULLSHOVELS
SKIMMERS
NORTHWEST
GASOLINE, OIL
DIESEL OR
ELECTRIC
POWERED
BUILT IN A RANGE OF 15 SIZES — 3/8 YD. CAPACITY AND LARGER

A New Utility Grader

A many purpose machine, introducing a new method of grading, has been announced by A. W. French, 8524 Vincennes Avenue, Chicago, Ill. This French utility grader not only cuts grade, subgrade, and form grade but can be used as a shoulder machine. It may be used for borrow, grade and drain finishing, leveling, stripping and loading top soil or excess material into trucks or discharge it on either side of the machine, and as a material loader for sand, gravel and such material from stockpiles.

The machine consists of a substantially built main frame or chassis, equipped with a standard pair of crawlers. A leveling frame, supported at each corner by a heavy jack, carries a set of rails upon which the cutting element travels. Belt conveyors receive the discharge from the buckets. An extension belt conveyor for elevating material into trucks and an end chute for discharging material along the road are placed interchangeably at either end of the reversible belt conveyor.

Each of the four jacks are power-driven and can be independently operated. By means of these jacks and pointers attached to the leveling frame the cutting element is kept in positive relation to the grade line. The rails upon which the cutting element travels may be shaped to conform to any contour desired and are interchangeable. A leveling blade or share is suspended from the leveling frame, extending across the entire cutting width of the machine. The cutting element is built on a heavy steel frame and consists of a series of bucket shaped cutters, so connected together as to form an endless chain. The buckets discharge material into a hopper which in turn delivers the material to the belt conveyor.

The buckets are placed in front of and cut a clear path ahead of and across the entire width of the machine. The crawler tracks then travel on the finished grade. The leveling blade carries surplus dirt for deposit in the cut grade to any desired depth for roller compaction.

The French utility grader is built in one size only, actually cutting to a width of 13 feet. When used on 20-foot roadways, one-half of the road is cut at a time. The unit has a loading capacity of from 60 to 90 yards an hour and a grading capacity up to 250 feet an hour of 12-foot subgrade. Its forward cutting speed is 4½ feet a minute and its forward traveling speeds are 18 feet and 72 feet a minute. Power is furnished by two 4-cylinder gas engines.

New York Office Moved

Hercules Powder Co., of Wilmington, Del., has announced that its New York City offices have been moved to 22 E. 40th St., at Madison Ave. Walter M. Annette is Manager.

Low-Cost Electric Service for Construction Camps

A 1,000-watt, 32-volt electric plant complete with a heavy-duty 140 ampere-hour battery has been developed by the Victor Mfg. Co., Adrian, Mich., to furnish electric service in construction camps. The engine is of the latest type Briggs & Stratton 2-horsepower, 4-cycle unit recognized as a high-grade air-cooled machine. The Robbins & Myers generator is mounted on ball bearings to insure smooth operation. The units are coupled with a high grade flexible coupling and the base is carefully machined to insure permanent correct alignment. The instrument panel, which is only necessary in the battery charging type, is made up of high-grade material and instruments. The manufacturer states that this plant will carry a 33.3 per cent overload.

The Bear type batteries used with the set are compact and long-lived. Each case delivers 16 volts. The manufacturer believes that this type of battery is destined to replace to a large degree the glass jar type. This equipment is made by a nationally-known manufacturer of heavy-duty farm light plants.

New Crawler-Mounted Drag-Scraper Machine

A new machine combining the long range capacity of the drag scraper with the direct loading action of other types of mechanical loaders has been announced by Sauerman Bros., Inc., 464 So. Clinton St., Chicago, Ill. This Sauerman scraper-loader is a crawler-mounted drag scraper machine completely portable under its own power. It is suitable to any work that requires moving materials from a pit, bank or stockpile and loading the material into trucks or other form of transport.

One man operates the machine and has four simple levers to handle; two of these levers control the scraper and the other two control the steering and travel of the machine. When moving to a new location, the scraper bucket is drawn to the top of the ramp and the lower apron of the ramp is raised clear of the ground.

The Sauerman Scraper-Loader

Sauerman scraper-loaders are offered in four sizes, equipped with Crescent scraper buckets of ½, ¾, 1 and 1½ cubic yards capacities. The operating spans range from 200 feet for the ½ yard machine to 400 feet for the 1½ yard unit.

KEEP AHEAD OF SCHEDULE

This FREE Maintenance Guide shows you HOW

● You'll find all the answers to problems in hard-facing worn parts and repairing broken parts of construction machinery and equipment in this 16-page arc welding guide. Contains complete description of the proper procedure for welding various jobs.

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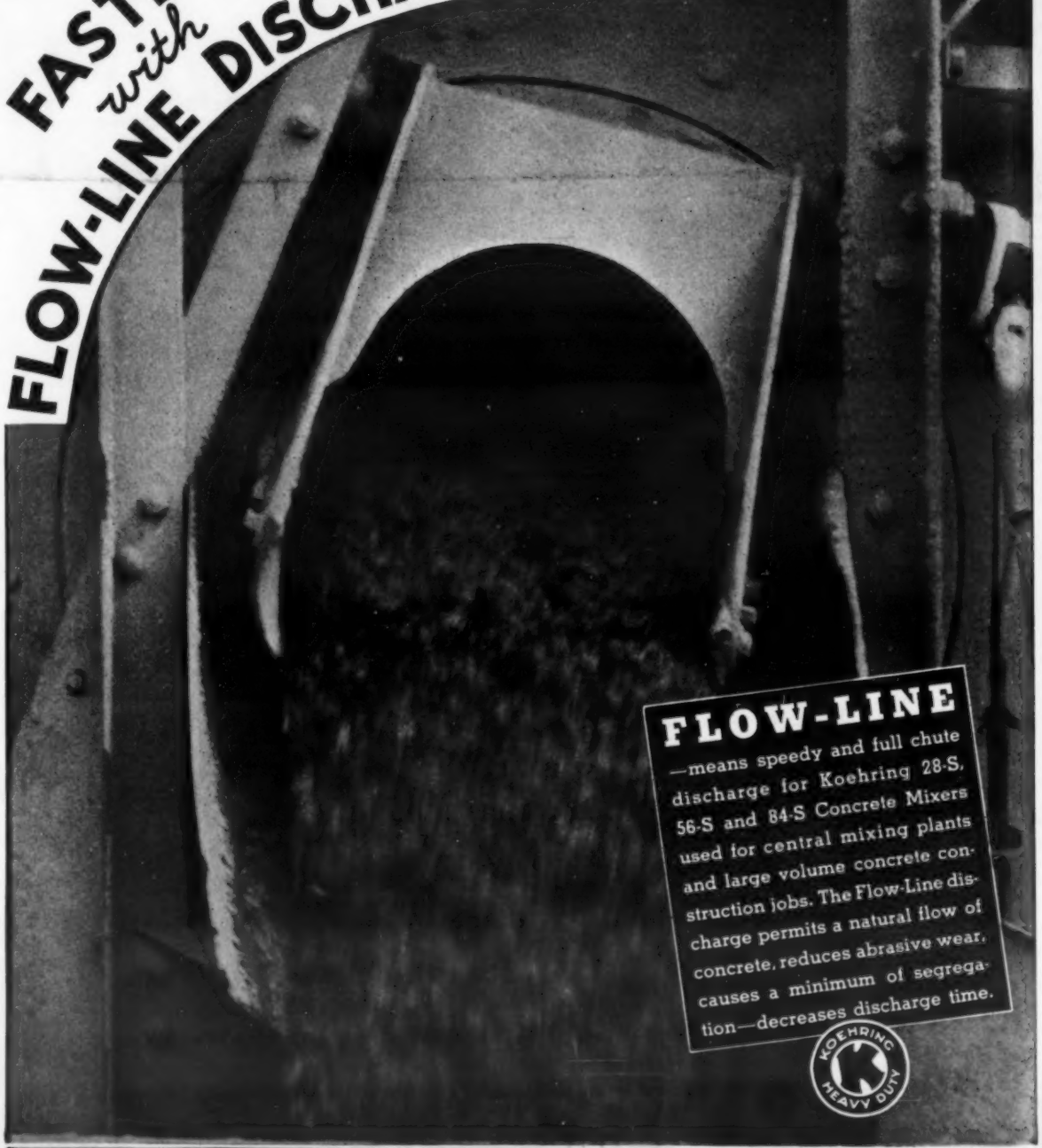
THE LINCOLN ELECTRIC COMPANY
Department XX-252 Cleveland, Ohio
Largest Manufacturers of Arc Welding Equipment in the World

KOEHRING

FASTER with FLOW-LINE DISCHARGE



FLOW-LINE
—means speedy and full chute discharge for Koehring 28-S, 56-S and 84-S Concrete Mixers used for central mixing plants and large volume concrete construction jobs. The Flow-Line discharge permits a natural flow of concrete, reduces abrasive wear, causes a minimum of segregation—decreases discharge time.

KOEHRING HEAVY DUTY

KOEHRING COMPANY
Pavers · Mixers · Shovels · Cranes · Draglines · Dumptors · Mud-Jacks
3026 WEST CONCORDIA AVENUE, MILWAUKEE, WISCONSIN

Unusual Restrictions for Rock Excavation

(Photo on page 40)

CalumetPavingCompany Removed 80,000 Yards of Rock Near Quarries for 4.1-Mile Paving Job

BEDFORD, Indiana, is in the center of the limestone district of the country and the products of its quarries are seen as building stone in court houses and post offices the country over. To protect this great natural resource from possible damage by blasting with high explosives, which are never used in the quarries themselves, the local limestone companies around Bedford and Oolitic have made arrangements with the State Highway Commission that whenever there is to be any highway construction involving rock cuts adjoining their property they will be permitted to control the method of blasting.

Such was the case in the heavy rock excavation on State Highway 37 between these two towns where 20-foot cuts were made in the limestone ledges. The requirement for safe blasting in this section is to use black powder and snake holing. Thus with the block of limestone to be removed carefully drilled horizontally at the base and vertically where it is to be detached from the ledge and with the use of a small amount of black powder, the block is moved slightly away from the mother ledge. After that the contractor can use as much powder as he wants to blow it to bits for handling with his power shovels.

Blasting for 4.1-Mile Job

A 4.1-mile grading and paving project 92A was started October 10, 1934 between Bedford and Oolitic. The work involved the removal of 107,000 cubic yards of earth excavation and 80,000 yards of rock. Two large rock cuts featured the work, one about ½ mile from the south edge of the town of Oolitic and the other, and larger, one mile south of the same place.

The larger cut was 2,100 feet in length, had a maximum depth of 15 to 20 feet and involved the removal of 55,000 cubic yards. In the fall the contractor removed about 15,000 yards at the north end of the cut to permit the bridge contractor to get to work at Salt Creek. The entire work was undertaken under traffic with flagmen and completed without a single accident. This major cut was taken out in 12-foot lifts and in some short sections in 3 and 4-foot lifts. All stumps were first removed by hand where they were under 18 inches diameter, and the larger ones were blasted out.

There was very little overburden on the north end of the cut and an average of 4 to 5 feet with a maximum of 10 feet around some water-worn knobs of limestone. The rock was drilled with jackhammers operated by three Ingersoll-Rand 240-foot air compressors. A Cleveland wagon drill handled the maximum depth of holes, around 12 feet, using 6 and 12-foot drill steel of 1½-inch diameter. The wagon drill worked with remarkable speed in this rock, requiring but 4½ minutes for a 12-foot hole and of this time ½-minute was used to change the drill steel. I-R and Timken detachable bits were used throughout for drilling. The average holes were approximately 8 feet in depth.

Hercules black powder was used throughout for blasting as it broke the material into sizes convenient for the Bucyrus-Erie 34B 1½-yard shovel, with an Amsco rock bucket and Caterpillar diesel power, to handle. A Northwest 1-yard shovel was used for removing the overburden. Both earth and rock were loaded to five Euclid and two Athey crawler wagons of 7 and 8-yard capacity hauled by Caterpillar Sixties. The state specifications usually call for a free haul of 1,900 feet. On this contract the average haul was around 1,500 feet and the maximum haul 4,300 feet. The proposals had items covering the excavation and disposal of rock between certain balances so that the usual free-haul specification did not hold. The contractor bid about 10 cents more on the earth item and the same on rock for the special haul items.

Rock and Earth Fills

The rock fills were spread in 10-foot lifts and the top of each lift chinked with spalls and on the top of the completed rock fill an 8-inch layer of earth was spread and bladed. A Caterpillar Fifty diesel with a Euclid bulldozer pushed the large and small rocks into

(Continued on page 21)

C. & E. M. Photo

Loading Black Powder Into One of the 12-Foot Holes

A MODERN Housing Project—spread over a 400-acre area—called for 17,000 cubic yards of concrete distributed in 250 small homes—a powerhouse—and a community building.

By forgetting equipment and set-up that was already planned, and figuring with two Rex Moto-Mixers, the contractor saved 29c per yard on the estimate based on the use of the old equipment.

Too high a regard for the present equipment list and methods of the years before is often the load that shoots up cost and slows down the job.

In 1936, before you buy, before you bid, investigate the Up-to-Date Methods of Handling Concrete.

CHAIN BELT COMPANY
1666 West Bruce St., Milwaukee, Wisconsin

REX
CHAIN BELT COMPANY
of MILWAUKEE
Construction Equipment

USE RIGHT BUCKET FOR THE JOB

Hayward makes all four — clam shell, drag-line, electric motor, orange peel. A Hayward recommendation is unprejudiced.

THE HAYWARD CO., 32-36 Dey St., New York
HAYWARD BUCKETS

King Cotton for Roads Tried in Many States

Bituminous Roads To Be Reinforced, Concrete Cured by Cotton in Nationwide Tests

UNUSUALLY severe winter weather, unprecedented floods and $1,300,000 allocated by the Department of Agriculture for demonstration construction have combined to focus the attention of road builders throughout the country on the use of cotton fabric membrane to reinforce bituminous surfaced highways.

Inquiries received by the Cotton-Textile Institute from highway authorities of a dozen or more states asking for details of the plan to make cotton reinforcing membrane available to the states gratis indicate that the damage to bituminous surfaced highways as a result of winter weather and floods will run into many millions of dollars. In some states from 1,200 to 1,400 miles of such highways must be retreated or completely rebuilt. In others, hundreds of miles, weakened by the exceptional strains, have been closed to heavy traffic.

Cotton Utilization Program

In order to promote a greater utilization of cotton in road construction, the Secretary of Agriculture has made available $1,300,000 worth of cotton to the various states. Two programs are planned, one to use cotton mats for curing concrete pavements and the second to use cotton fabric as membrane reinforcing in bituminous surfaced pavements.

In order to obtain a widespread distribution of these materials in highway construction, the Federal Government, through the Cotton Marketing Section and with the cooperation of the U. S. Bureau of Public Roads, will make available to state highway departments gratis supplies of cotton mats and fabric as may be requested in amounts sufficient for adequate trials and demonstrations, on condition that the state highway departments agree to use them or have them used in an approved manner in road construction and also that they use reasonable diligence in securing and recording such information as may be necessary for a future evaluation of the benefits derived.

On account of its close association with the state highway departments and its paramount interest in highway construction, the Bureau of Public Roads will assist in furthering these programs by bringing them to the attention of the state highway departments and by assembling and transmitting to the Secretary of Agriculture the requests for material.

Use of Cotton Mats

The cotton mats are to be used for curing concrete pavements in much the same manner that burlap is used. The mats should be applied wet to the surface as soon as possible after it is finished and should be kept wet until removal. A flap is specified along the edge of the mat to insure complete covering of the pavements at the joining between adjacent mats. The mats are laid with the flaps in the direction of progress and each mat is laid on top of the flap of the preceding mat.

The efficiency of cotton mats for curing has been fairly well established but it is desired that the highway departments take advantage of the opportunity to secure a supply of these mats to obtain data regarding the approximate average life of the mats and the average cost of curing per square yard of pavement under varying conditions and to report this information to the Bureau of Public Roads.

Request for Mats

Approximately 80,000 mats of standard size, 22½ feet long, will be available for the United States as a whole. It is anticipated that offers can be accepted for mats sufficient for several introductory projects in each state having an extensive road program.

Sixty days will probably be required to supply the mats after offers have been accepted. Therefore applications should be made early, especially where mats are desired for several experimental projects.

Use of Cotton Reinforcement

Experiments have been conducted over a period of years, especially in South Carolina, to determine the value and feasibility of reinforcing bituminous surface treated highways with membranes of cotton fabric. To date, however, the total mileage is small and most of it is confined to South Carolina. It is desired therefore to secure more data on the use of this fabric under a wide variety of climatic and other conditions.

The fabric is to be used as a reinforcement for thin bituminous surface treatments on previously consolidated bases of adequate thickness, of the stabilized soil types such as sand-clay, top-soil, or sand-clay-gravel, or waterbound macadam or other types of base suitable for surface treatment.

The base is first primed with bituminous material and the fabric is then spread longitudinally in overlapping strips covering the full width of the primed surface. The general practice has been to spread the fabric while the prime is sticky enough to hold it in place. This practice is advantageous in securing some impregnation of the fabric with the thin bituminous priming material.

As soon as the prime has cured sufficiently, the surface treatment, consisting of one or more applications of bituminous material and crushed mineral aggregate, is applied. In South Carolina it has been the practice, just prior to the surface treatment, to spread crushed aggregate cover material over the cotton fabric, at the rate of 5 to 10 pounds per

(Continued on page 26)

THE PARSONS CO.
Manufacturers of
- TRENCH EXCAVATORS
- TRENCH BACKFILLERS
- TERRACING GRADERS
- SNOW PLOWS
- ROAD RECLAIMERS
- BLACKTOP TRACTION MIXERS

Write for printed matter
THE PARSONS CO.
NEWTON, IOWA

EVERY ONE OF 'EM WITH DIESEL POWER

AGAIN P&H sets the pace: this time by powering its full line of excavators with Diesel engines . . and by building for Diesel power.

LOOK at a line from which you can select any size with full Diesel engines as standard equipment — not near-Diesels, nor makeshifts, but husky, proved Diesels manufactured by the nation's leading engine builders.

LOOK at a line in which you can have not only the economies of low Diesel operating costs, but the advantage of low upkeep costs. P&H builds for Diesel power—every part is designed to stand up under the heavy "lugging" ability of a Diesel.

LOOK at a line in which less dead weight, lower inertia, plus higher Diesel power means continuous high production in every kind of digging. . . . Only P&H offers you a *full line* of shovels powered by Diesel as standard equipment. Diesel power plus the pacesetting P&H chain crowd plus new streamlined dippers plus many other outstanding improvements mean new production records for any P&H owner. Write today for information on the many features of the P&H Pacemakers for 1936.

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4419 W. NATIONAL AVE. *Established 1884* MILWAUKEE, WIS.
Warehouses and Service Stations:
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No. 1 with plenty more to come

Gas engine power is also available, where desired, on any P&H machine.

P&H PACEMAKING FEATURES MEAN PACEMAKING PRODUCTION ON THE JOB

P&H PACEMAKERS···FASTER IN THE FIELD

Sweeping Gravel From the Road in Oregon

Contractor Sweeps Road

Trucks hauling gravel over a state highway in Oregon scattered gravel en route to such an extent that the safety of the road was endangered. The contractor, L. E. Gates, who is building the $156,000 widening project on the Salmon River, Oregon, cut-off, has been running an International industrial tractor of the smallest size equipped with a revolving road sweeper over this route to keep the gravel off the road surface. This unique equipment for safety is shown in the accompanying illustration.

Repairing Brick Pavement

The general method of repairing brick pavement used by the Ohio Department of Highways is to remove the defective pavement, repair the base if necessary, reshape the cushion, clean the brick and relay to proper grade and crown. Where utility companies have to open pavements, permission is granted by the Department upon the payment of a flat rate fee which in the case of brick pavements is $3.00 for each opening plus $1.25 per linear foot for trenches 18 inches wide and under, and $5.00 for each additional square yard outside the 18-inch trench. The pavement is replaced by the state maintenance forces.

From specially kept records in one division, reports G. M. Anderson, Chief Engineer of Maintenance, the cost averages $5.50 per square yard, which includes foundation repair and using new brick where necessary. In another division where some extensive repairs were made in 1935, the cost was $5.00 per square yard for repair between 5 and 50 square yards and $3.50 for large repair of 400 square yards and up.

There are 1,437 miles of brick pavement in Ohio.

New Principle of Rotation Used in I-R Stoper

A new Stopehamer which is claimed to be faster and more powerful than any of its previous models has recently been announced by the Ingersoll-Rand Co., 11 Broadway, New York City. This new tool makes use of an entirely different method of rotating the drill steel, and the usual pawls, pawl-springs and ratchets are no longer used.

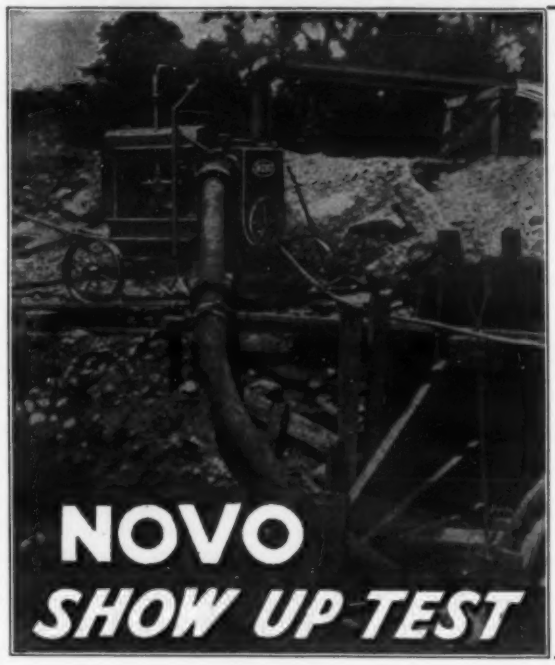
A reciprocating motion is imparted to the rifle bar by the movement of the piston, assisted by air pressure applied alternately to the faces of the rifle bar head. When the piston moves forward, the teeth of the rifle bar are actually lifted out of engagement, and the bar is rotated freely. When the piston reverses the teeth are forced back into engagement in an advanced position. The returning piston is rotated by the helical flutes of the locked rifle bar, causing the steel to rotate.

The rifle bar teeth can be held out of engagement by air pressure controlled by the throttle valve. Thus hammer action without rotation is available for collaring a hole. This pneumatic "on-off" control without extra levers or buttons is made possible by the new rotation principle.

The new Stopehamer is made in two sizes designated at SAR 120 and SAR 85. Both are light in weight and low in air consumption. They are described and illustrated in Bulletin No. 2245, copies of which may be secured from the Ingersoll-Rand Co.

From Foreman to Manager

Two men who started as apprentice and foreman have reached managerial positions in the Caterpillar Tractor Co., Peoria, Ill. M. Rogers who entered the C. L. Best Tractor Co. in 1922 as foreman of the turret lathe department has been named General Factory Manager of Caterpillar. James R. Munro, who succeeds Mr. Rogers as factory manager of the Tractor Division, enrolled for the four-year apprentice training course in the C. L. Best Tractor Co., in 1918.



Shows Up
The Difference
IN 6" SELF-PRIMERS

Go through it from radiator cap to discharge flange, compare it part for part.

For instance, the Power Unit is 35% larger than others used. Has 30 cu. in. more displacement.
A 5-bearing crankshaft, not a 3.
A 3" crankshaft, not a 2½".
Water pump cooling, not Therme-syphon.

Look at the Pump:
2-bearing impeller shaft (ball bearings).
Leather seals that eliminate packing.
A real self-cleaning pump case.
Easily accessible impeller (just remove the handhold plate).

Now then compare the volume of water, the cost of maintenance, and the general performance of the Novo Pump on the job. They all say, IT COSTS YOU LESS TO OWN THE BEST—THAT'S NOVO.

2", 3", 4", and 6" Self-Priming Centrifugal Pumps.

Novo Engine Company
216 Porter Street
LANSING, MICHIGAN

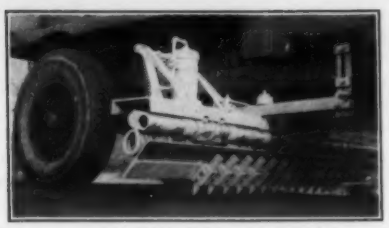
All Year Round **ADAPTABILITY**

In the April issue of Contractors and Engineers Monthly, we showed an illustration of a Walter motor truck equipped for snow fighting. The beauty of the Walter unit is its utility for various types of service. At a small extra cost, the Walter may be equipped with the center type of road scraper or maintainer, thus enabling a municipality or county to secure all-year-round service from the Walter unit. The super-traction of the four-point positive drive avoids wheel slippage so that roads can be scraped immediately after rainfall without damage to the road surface.

The Walter unit has the power and traction to pull even the largest and heaviest types of graders for all leveling and ditching operations. For cutting back side banks or other heavy pull conditions, the super-traction and steady pulling of the Walter are of great advantage. The transmission and drive system have the proper reserve for this strenuous service.

We have prepared interesting folders illustrating and describing the various uses of Walter truck units which will be sent on request if you will forward your address.

WALTER MOTOR TRUCK COMPANY
1001-19 Irving Avenue, Ridgewood, Queens, Long Island, N. Y.



A Spring-Scraper With Scarifier Attachment

Maintenance Blading at 15 Miles Per Hour

It is possible to maintain earth and gravel roads by blading at speeds of 10 to 15 miles per hour, using Willett spring-scrapers mounted on different makes of trucks. With either a flat or curved blade and curved moldboard, they handle loose earth and gravel. Heavy hydraulic pressure can be used on the scrapers for cutting out corrugations, hard spots and ruts.

The Willett Mfg. Corp., Plymouth, Ind., also makes a scarifier that can be mounted on the Willett spring-scraper for handling shallow scarifying. Models and sizes of spring-scrapers are made for all makes of trucks from 1½-ton up.

The Willett Mfg. Corp. recently purchased the plant and equipment of, and are successors to, the Lee Trailer & Body Co., Plymouth, Ind., manufacturer of dump bodies, loaders and semi-trailers. Willett is continuing the manufacture of dump bodies and semi-trailers in addition to its regular line of road machinery, spring-scrapers, snow plows, and road and street sweepers.

Complete information on the Willett line of equipment may be secured by writing direct to the company.

Death and Diversion of Road Funds Linked

Death and diversion of highway funds go together, according to a study recently completed by the American Petroleum Industries Committee and reported in *The Nerba*.

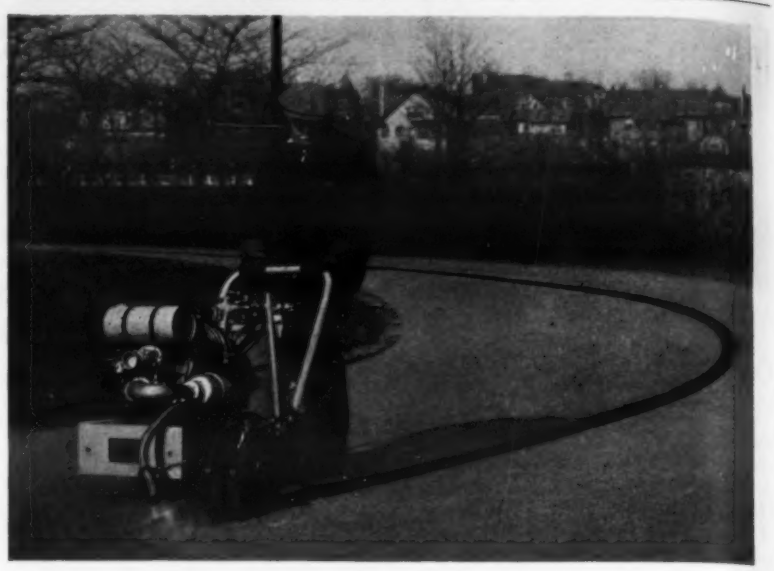
Using the number of registered cars as a basis, it was found that the 24 states which had a higher than average death rate included 17 which practised diversion; while a third method of comparison based on the death rate per 100,000 population showed that 13 of the 24 states with the highest death rates practised diversion in some form.

"There have been numerous attempts to discover the principal reason for highway accidents and deaths," said Baird H. Markham, Director of the American Petroleum Industries Committee. "If it were possible to sum that reason up in one word, that word would be 'congestion,' with all other considerations as contributor causes.

"Each dollar of gasoline tax or license money diverted to other purposes prevent elimination of hazardous congestion."

The total amount diverted in 1934, as reported by the American Association of State Highway Officials, was $136,000,000, which would have built or improved 13,600 miles of highway at an average cost of $10,000 a mile.

Another form of diversion, Mr. Markham pointed out, consists of diverting fund from roads badly in need of improvement as shown by traffic counts, to roads whose traffic does not justify additional investment. If roads were constructed solely on the basis of traffic requirements determined after scientific study, this would be avoided.



THE LITTLEFORD TRAF-O-SPRAY

The addition of a Traf-O-Spray to your maintenance equipment will put an end to your line marking worries. At the same time, you will be using it almost constantly painting stencils, air directional signs, other equipment, guard rails and buildings.

Its light weight, shortness and general ease of handling adapt it to all kinds of traffic marking. Built with machine tool precision, this outfit requires very little care or adjustment and is always ready to serve you. Write in today for prices and full particulars.

LITTLEFORD
Traffic Line Marker
TRAF-LB-SPRAY
LITTLEFORD BROS. 485 E. PEARL ST. CINCINNATI, O.

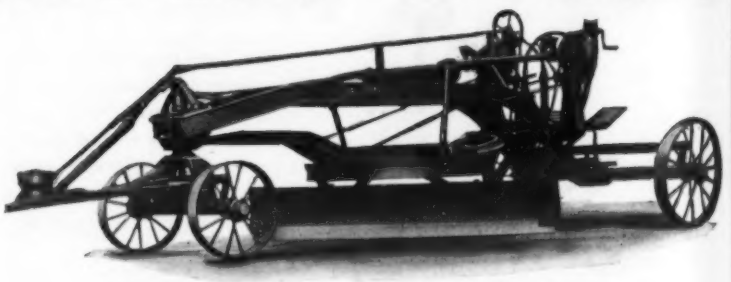
GALION Road Rollers and Graders

There is a GALION Road Roller of the exact size to meet any requirement you may have:—

Do you wish an exceptionally easy-operating heavy-duty roller? The "Chief" (10 or 12-ton size) is the answer. Equipped with hydraulic steering and hydraulic scarifier, roller-bearing front and rear rolls, and differential lock; electric starter optional at additional cost.

For lighter work, you get high-grade performance at lowest cost by using a "Warrior" (5, 6, 7 or 8-ton size). Equipped with worm and sector steering gear (hydraulic steering if preferred); hydraulic scarifier and electric starter at additional cost.

Both models, all sizes, are noted for their conveniently arranged controls, high comparative speed, and short turning radius.

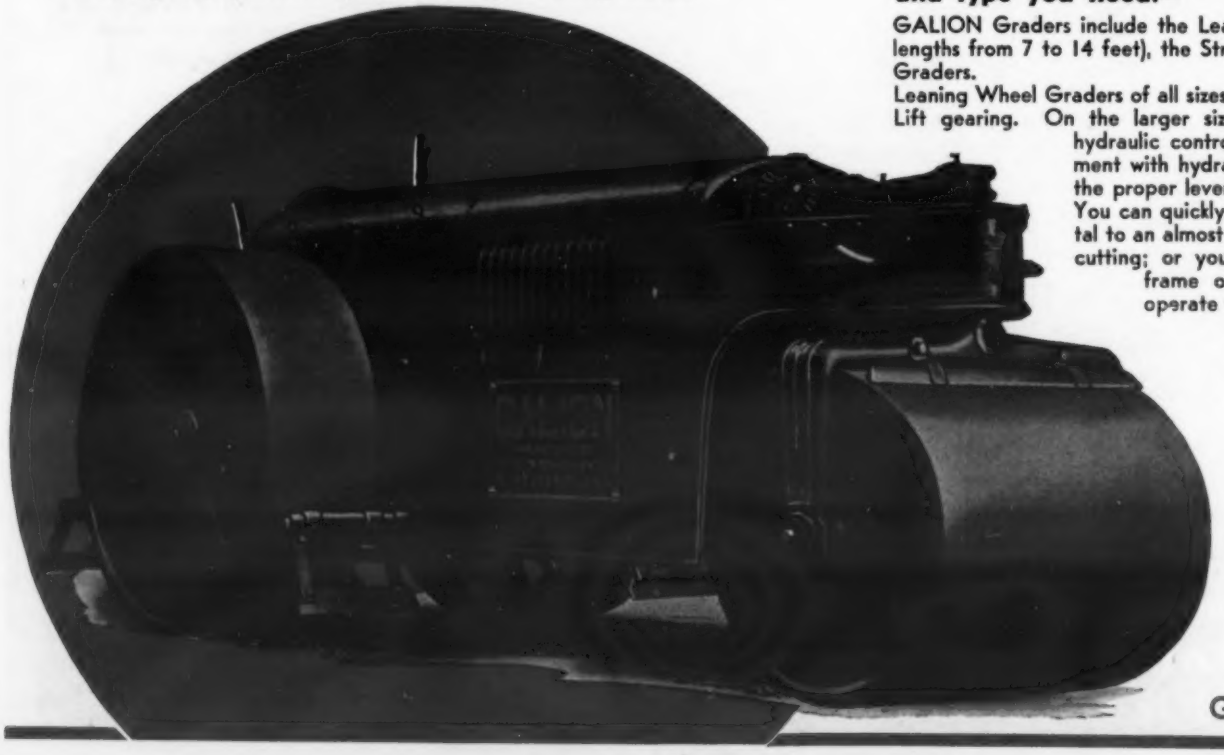


Galion No. 110 Leaning Wheel Grader with Manual Operation

There is a GALION Grader, too, of the exact size and type you need:—

GALION Graders include the Leaning Wheel type in ten sizes (blade lengths from 7 to 14 feet), the Straight Wheel type, and Motor Patrol Graders.

Leaning Wheel Graders of all sizes are equipped with the GALION E-Z Lift gearing. On the larger sizes (9, 10, 12 and 14' moldboards) hydraulic control is available. To make any adjustment with hydraulic control, you need only to touch the proper lever—the hydraulic power does the rest. You can quickly raise the moldboard from a horizontal to an almost vertical position in this way, for bank cutting; or you can lean the wheels, sideshift the frame or rear axle, adjust the scarifier or operate the steering gear, in the "twinkling of an eye." A Scarifier is furnished as additional equipment for any type Grader.



Other GALION products are:
Road Drags of various types
Stone and Asphalt Spreaders
Road Rooters

Also Grader Blades of high quality construction to fit all makes of Graders

Many Galion booklets available. Tell us what you are looking for, and we'll send you a booklet about it giving you some interesting information.

The Galion Iron Works & Mfg. Co.
Galion, Ohio

Indiana County Road Building

Heavy Construction Pushed by Southern Indiana County on Road with Increasing Traffic and Needed Link

By RICHARD H. HOFMANN,
Franklin County Road Supervisor,
Brookville, Ind.

TO MANY people the word "construction" applies almost entirely to projects under the jurisdiction of the state highway commission, while they consider that county highway departments should concern themselves, for the main part, with purely maintenance work.

This idea would be practical if the state highway commission could be prevailed upon to take over those roads which, by their importance to the traveling public, merit changes in location and type which cannot properly be made under the heading of maintenance. We have found, however, that in our locality, the state prefers to take over those roads which require the least cost to make them a part of their secondary road system. This leaves us with the problem of maintaining those roads upon which the burden of ever-increasing traffic demands not only a better type of surface but, in many cases, the elimination of steep grades, narrow fills and sharp turns—in other words, practically the construction of a new road.

In the past four years, we have found a place in our budget for this type of work, without materially crippling the work on our other roads, which consists principally of ditching and maintaining the road surface. During this time we have constructed about 100 miles of new grade and built approximately 60 miles of black-top surface, while at the same time keeping the remainder of our road system well metaled and well dragged.

Franklin County lies at the southern edge of the east central section of the state, the county seat, Brookville, being some 40 miles south of the National Road. The east part of the county is level, the roads being laid out on the rectangular system, while the western and southern part of the county are more or less hilly and typical of all southern Indiana counties.

Material and Equipment

Our maintenance material consists chiefly of bank and creek gravel. Our county road system comprises some 700 miles of road and our budget totals approximately $80,000.00 per year, derived from the gasoline fund. Our maintenance equipment includes five dump trucks, ranging in size from 1½ to 3½-ton capacity, one 5-ton Caterpillar and one 5-ton Allis-Chalmers tractor, with several maintainers, drags and small graders. Our heavier equipment consists of a Caterpillar Sixty, two 12-foot Adams graders and a ¾-cubic yard Universal shovel.

Total cost of our equipment (purchase price) would not exceed $30,000. This equipment has been purchased over a period of five years, making our average annual out-lay approximately $6,000 for new equipment. We are now in a position to tackle most any job, large or small.

A Typical Example

Of the new construction work, there are two projects of particular interest. One project, known as Trenton Hill, lies in the southeast section of the county. This section of road has been heavily traveled for a number of years, though still on a narrow steep grade with a creek following the lower course of the road. The length was approximately ¾-mile. To widen the roadway necessitated the moving of about 15,000 cubic yards of earth, the greater part of which was to be side-cast. At the time this project was undertaken, our equipment did not include a power shovel. We, therefore, contracted with the owner of one on an hourly rental basis of $4.50 for the use of a 1-yard shovel for this job. This outfit worked approximately six weeks at a cost of $1,800.00 for the shovel work. The remainder of the equipment and labor was furnished by the county highway department. In addition to the widening of the right-of-way, we placed on the project one 48-inch corrugated culvert 60 feet long and several smaller pipes from 12 to 18-inch in diameter. Since then we have made it a practice to use corrugated iron culverts only when a culvert of less than 30 inches in diameter is required, and concrete boxes

(Continued on page 33)

New Type of Machine Breaks Old Pavement

A new piece of equipment for breaking up old pavement which has to be removed to make way for a new road made its first appearance in Michigan on Hamer Bros. grade separation job in Flint. It was necessary to break up comparatively new 10-inch concrete reinforced with ¼ and ⅜-inch steel during the cold weather of last winter when the ground was frozen 3 to 4 feet underneath the concrete. It is reported that the machine did an excellent job of shattering the concrete, making it possible to remove the broken material quickly with yard shovels loading to motor trucks.

The outfit, which is made by the Novo Engine Co., Lansing, Mich., consists of a special gasoline-engine-driven single-drum Novo hoist with special collapsible leads and a specially-designed demolishing hammer. This hammer may be equipped with various types of breaking noses as well as a shearing knife for trench work and water line work. The shearing knife arrangement also can be used to trim old macadam, black top or concrete roads, in the process of widening them.

The entire outfit is mounted on a truck, making it easily portable, and also permitting the operator to secure maximum efficiency and braking speed, depending on the nature of the work to be done.

GRIFFIN WELLPOINT SYSTEMS
Have Dried Quicksand Jobs in 24 Hours
Exclusive Patented Money-Saving Features
Prove Their Value in Final Costs
Job layouts and estimates furnished
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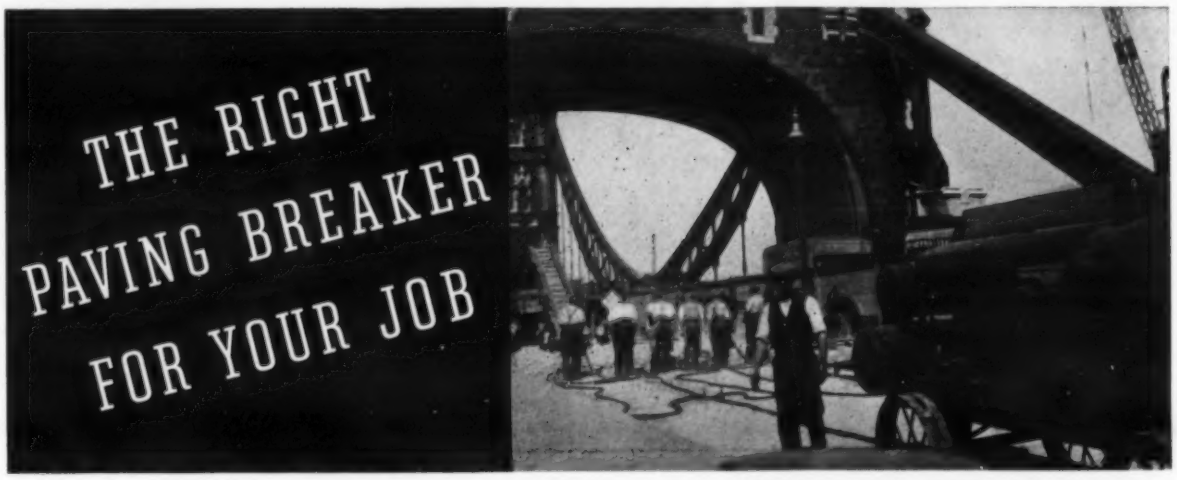

In the illustration above, six Cleveland C7 Paving Breakers are shown at work reconditioning the roadways of the famous old Tower Bridge over the Thames, adjacent to the Tower of London.

• In the Cleveland Line there is the exact Paving Breaker for the work you have to do. If it is hard re-inforced concrete, heavy and seasoned, you will want the Cleveland C9, with its long stroke and powerful, slugging blow. This machine is put up also as the C9SD Sheeting Driver, a hard hitter that drives light piling in a hurry, and without splitting or "brooming" the boards.

The C7 Paving Breaker is a slightly lighter tool, and is well suited to average work. Then there is the husky middleweight C11. At 54 pounds it is the most powerful breaker in its class. Model C10 is made with three styles of handles, as illustrated, and from this group a handy machine can be selected for demolition or other work requiring the operator to lift and direct the tool continually.

Above: The C9SD Sheeting Driver at the left of the line. The other machines are our various types and sizes of paving breakers, ranging in weight from 30 to 78 lbs.

At the right: The C10D Demolition Tool, the C10E Trench Digger, and the Standard C10 Light Paving Breaker.

Write us the nature of your job, and we will suggest a breaker and steels that will do the work at the minimum expense. Bulletin 110 gladly mailed on request.

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Michigan, 222 Heath St., Negaunee.
New England, 62 Maple St., Newton, Mass.
New York City, 200 Church St.
Richmond, Va., 12 North 15th St.
Salt Lake City, 501 Dooly Bldg.
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THE CLEVELAND ROCK DRILL CO.
3736 EAST 78th STREET CLEVELAND, OHIO

LEADERS IN DRILLING EQUIPMENT

Another Example of Need for Highway Lighting

Another interesting example of the need of adequate highway lighting to cut down the loss of life and property damage from traffic accidents comes from the General Electric Co. The following excerpt from a report on the first six months of 1935 issued by the Bureau of Statistics of the Interstate Commerce Commission appeared recently in *Railroad Data.*

"The report shows that 145, or 24 per cent, of the accidents occurred during daylight, while 454, or 76 per cent, occurred during dark."

This indicates clearly the importance of eliminating the fast-rising tide of night accidents at our railroad grade crossings. A few highway lights properly placed at each crossing would aid considerably toward such a reduction. The new sodium-vapor highway lighting luminaries, with their golden or amber color, would not only function as an illuminant, but would also furnish the customary amber or "warning" signal at a grade crossing.

Standards for Wire Screens for Aggregates Reaffirmed

The Division of Simplified Practice of the National Bureau of Standards has announced that Simplified Practice Recommendation R147-33, wire diameters for mineral aggregate production screens, has been reaffirmed without change by the standing committee of the industry. This recommendation, which covers wire diameters classified as light, standard light, standard heavy, and heavy, for specific clearing openings ranging from ⅛ to 3 inches, was effective February 1, 1933.

Copies of this recommendation may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents each.

There's economy in Stanolind Asphalt pavement for every traffic requirement

Braking action is positive on *Cut-Back* Asphalt paving and there's no glare to confuse or tire the eyes of drivers.

These safety factors are *extra values* which add to the popularity of the paving that is noted for its low first cost, long life, and low maintenance costs.

The knowledge and experience of Standard's representatives in the selection of materials and methods for any particular job is yours for the asking. Telephone your local Standard Oil (Indiana) office, or write.

Copr. 1936, Standard Oil Co.

ASPHALT goes farther

STANDARD OIL COMPANY
910 S. MICHIGAN AVE. (Indiana) CHICAGO, ILL.

IN LONG-WEARING ROAD MILES . . . *IN* DISTRIBUTION OF LABOR . . . *IN* TAXPAYER SATISFACTION

Foundation Problems on Subway Contracts

(Continued from page 2)

along the easterly side of the original Fifth Street so as to pass under a higher point on the bridge grade line and thus reduce the depth of the vehicular profile, and hence the length of the underpass, using 5 per cent maximum grades. In addition work had to be done without interrupting the heavy traffic over the bridge. The problem of working in the extremely close quarters necessitated by this underpass was partially solved by the skillful use of a Bucyrus-Erie electric shovel with a short boom and tail swing. Sheeting was handled as in the subway excavation.

As in the Philadelphia subways, the steel structure is of rectangular steel bents at 5½-foot centers, connected by concrete jack arches in the side walls and roof. The floor is of reinforced concrete under which are vitrified tile track drains. Waterproofing of the roof is by 3-ply fabric, 3 inches above the steel and protected with a 3-inch concrete slab. An outside firm delivered ready-mixed concrete in truck mixers. The station under Franklin Square is of the usual subway type with a platform suitable for an eight-car train.

The contractor on the Philadelphia side provided compressed air for his entire job through 6-inch mains from a central compressor house, operating two Imperial No. 10 Ingersoll-Rand electrically-driven compressors.

Excavation on Contract No. 1 amounted to approximately 108,000 cubic yards of earth, 25,400 cubic yards of concrete was poured, and 2,755,000 pounds of structural steel was erected. The cost estimate at the time of award was $998,394.15. The work was managed for Builders, Inc., by Perry Goldman, Chief Engineer and Carl Pierson, General Superintendent.

Problems in Camden

In Camden the subway swings away from the bridge approach in a southerly direction and continues under Fifth Street until it meets the Pennsylvania-Reading Railroad embankment. At this point the subway swings easterly parallel to the embankment, and ends in a terminal at Broadway. As Fifth Street is lined with buildings ranging in size from large churches and office buildings to small brick residences, considerable care was exercised to assure that the foundations of these structures would not settle as a result of this excavation.

The Camden soil consists mostly of sand, loose clay and river mud, with a mean high water level of the Delaware River nearly 10 feet above the lowest subway floor level. Under such conditions it was decided by the bridge engineers to line both sides of the excavation area with steel sheet piling driven 9 feet below subgrade. In addition, the two contracts for the work on the Camden side placed the entire responsibility for building damage on the contractors.

Contract No. 2 was awarded to the Marcus Contracting Co., and included the subway construction from the bridge approach to Fifth and Federal Streets in Camden, a distance of about 2,300 feet. Also included in this contract was an underpass to carry Fourth Street below the bridge tracks.

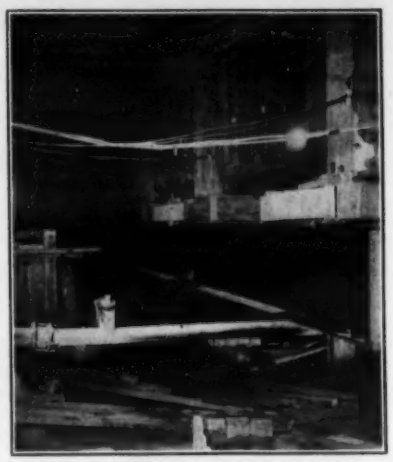
Before driving sheet piling, this contractor reinforced the foundations of the adjacent buildings. For the most part this was done by first reinforcing and extending the wall foundations to water level, then underpinning the foundations at strategic points with 12-inch pipe piles jacked down to a level below that of the sheet piles. Finally, the pipe piles were filled with concrete.

This contract required 1,700 tons of Carnegie 22-pound sheet piling approximately 40 feet long. These were driven between timber liners by means of McKiernan-Terry hammers. With the sheet piling in place, the contractor used Lorain and Koehring gas shovels to make a 10-foot surface cut. Timber cross bracing was then installed and the excavation decked over.

The major portion of the excavation was mucked out by Lorain, Osgood and Koehring cranes, operating through removable sections of the decking. Final grading was by hand. Two systems of Complete 1½-inch self-jetting wellpoints at 6-foot centers with Carter pumps were utilized to prevent boiling at the lower grades. During the pouring of the invert concrete these wellpoints were inclosed in sleeves and left in place. Later the points were removed and the sleeves dry packed with concrete.

After the erection of the structural steel on the invert concrete, concrete wales were cast in place of the temporary steel wales to take the side thrust of the sheet piling. Following the construction of the permanent wales, Blaw-Knox steel jack arches were erected for the side walls and roof. Electrically-driven vibrators made by the Concrete Vibrator Equipment Co. were used to settle the concrete in walls and roof. As in Philadelphia, concrete was trucked

(Continued on page 20)



Transferring the Load of the Bridge Approach Foundations in Camden to a Pair of Transverse Steel Girders

CONCRETE VIBRATORS

Air operated vibrators for all classes of concrete construction including Bridge deck slabs, Dams and Locks. Highway pavement and Concrete products.

Write for circulars and engineering data.

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BUCYRUS-ERIE

all-welded, straight-line steel booms have proven their ability to stand-up-and-take-it on hundreds of tough jobs. And, as you know, Bucyrus-Eries are invariably picked for the toughest assignments. Of thoroughly seasoned design, both booms and sticks are arc welded by skilled craftsmen using the most modern equipment. There is no better front-end built for satisfactory speed performance.

Illustrated is the front-end of the 48-B, new Bucyrus-Erie excavator that has set new standards of output economy and profit making ability. Note the bowl door dipper; 42-inch twin, live, boom-point sheaves; simple, reliable, positive chain-crowd; dependable power dipper-trip.

BUCYRUS ERIE

EXCAVATING, DRILLING, AND MATERIAL HANDLING EQUIPMENT... SOUTH MILWAUKEE, WISCONSIN, U. S. A.

A RECORD— Three Million FORD TRUCKS AND COMMERCIAL CARS

In this month of May, 1936, Ford Motor Company completes the building of three million trucks and commercial cars . . . one-third of all that have been built since the beginning of the industry.

There is no substitute for experience. Ford experience has been twofold. In addition to advancements in methods of manufacture, Ford engineers have gained a first-hand knowledge of the needs of owners in every field of hauling and delivery service. They know WHAT to build, as well as HOW to build it. They are able to design and construct units with exact knowledge of requirements . . . to anticipate changes in operating conditions and even to bring about such changes.

The 8-cylinder V-type engine, introduced by Ford into the commercial field, did just that. Bringing power to haul heavy loads at high speeds . . . and the flexibility to cover delivery routes quickly . . . it cut operating costs in all kinds of service.

Ford V-8 Trucks and Commercial Cars have been proved by the past. Experience has improved them for the future. Find out what Ford experience can contribute to your business. Call a Ford dealer today and set a date for an "on-the-job" test with your own loads, under your own operating conditions.

FEATURES OF THE FORD V-8 TRUCK

85-horsepower V-8 engine with full cylinder-length water-jackets, floating-type connecting-rod bearings, dual down-draft economy carburetor, and duplex intake manifold, exhaust valve-seat inserts, factory-set permanent valve clearances, direct-driven ignition, positive lubrication system, directed-flow crankcase ventilation.

- More ideal load distribution
- Full-floating rear axle
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- Full torque-tube drive
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- Durable baked-enamel finish
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- Heavy-duty transmission
- Centri-force clutch
- Coupe-type cab of all-steel construction, including roof
- Safety Glass standard throughout

Ask your Ford dealer about the Ford Engine and Parts Exchange Plan

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Any new 112-inch wheelbase Ford V-8 Commercial Car can be purchased for $25 a month, with usual low down-payment. Any new 131½-inch or 157-inch wheelbase Ford V-8 Truck can be purchased with the usual low down-payment on the new UCC ½% per month Finance Plans.

FORD V-8 TRUCKS AND COMMERCIAL CARS

Model Helps Operation of Bonneville Cableway

(Photo on page 40)

SOME interesting side-lights in the operation of a large cableway system are revealed by D. P. (Dave) Williams, superintendent of cableways for the Columbia Construction Co., contractor on the spillway dam of the Bonneville power project. For three years, up to last March, he operated the cableways at Boulder Dam. On that date, he went to Bonneville to lay out and supervise the erection of the cableway there, much of which was brought from Boulder.

The cableway now in operation at Bonneville has a span of 2,025 feet. The twin radial tail tower, 225 feet high, is located on the Washington shore, while the two traveling head towers, each 90 feet high, are on Bradford Island. The two lines are of 3-inch lock coil Columbia cable. Upon them travel the carriages and Lidgerwood slack carriers. For bringing the concrete across the river to the south cofferdam excavation, two buckets are now being used, one an F. T. Crowe automatic dump and the other of Columbia Construction Co. design, dumped manually by a rider. Each is of 8-cubic yards capacity, and each, with its tackle and 16 tons of concrete, weighs approximately 25 tons.

Power for the operation of the system consists of a 3-drum Lidgerwood cableway hoist with 500-hp motor in each head tower. The operation of each cable is controlled by one man in the hoist house who is not in a position to see the excavation or any of the movements of the bucket. All instructions as to the manipulation of the bucket are received by telephone from a signal man down in the "hole." The latter has outlet stations where he can plug in his extension cord at intervals of 100 feet along the dam. Both tower man and signal man wear telephone head-set receivers, and have large horn-type transmitters, that of the tower man being suspended in front of him so as to leave both hands free for the manipulation of the remote control levers.

The speed of travel is 1,200 to 1,500 feet per minute. The average bucket round trip is made in 3½ minutes, which includes spotting and filling the bucket and placing the concrete on the dam.

How the Model Helps

One is very likely to find Dave Williams in the rigging loft beside the head-tower track, and often it will be at his model cableway erected in the loft. This model is built to scale and many of the problems of erection and operation are worked out by its aid. He has been engaged in cableway work for 25 years and some of the improvements he has made in cableway equipment and methods of operation have been made possible through models of this character.

Dave Williams, Supt. of Cableways, Solves Many Problems on His Complete Scale Model

"When trouble occurs," says Dave Williams, "the thing to do is to check through systematically, just as an automobile mechanic would check through your car. Something is wrong, for instance, with the button slack carriers. Say they foul on the horn. We know that they foul, but why? There are a great many adjustments to be made on a carrier, and it is not easy to climb all over a 2,000-foot cable to find out what is wrong. So we put the model through the same paces and duplicate the trouble, then we know how to remedy it on the actual cable in the shortest time.

"Or again, in the erection of the cableway, such a model comes in handy. While we have our plans as carefully worked out in advance as possible, it is not always that everything goes together with that fraction of an inch fit required in many places. Then binding will occur and freedom of action

(Continued on page 30)

D. P. Williams, Superintendent of Cableways, and His Model of the Bonneville Cableway on Which He Worked Out Many Operating Problems

Deepening and widening the Quiloene River, to prevent floods, this "Caterpillar" Diesel Tractor works with a bulldozer at a fuel cost of less than 12 cents an hour.

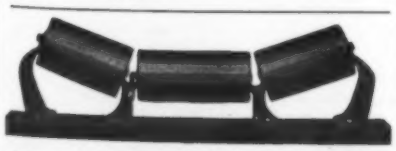
The difference between today's and yesterday's tractor power costs is the difference between the "Caterpillar" Diesel Tractor and the gasoline machine. Today, bids are made and contracts won on the savings that "Caterpillar" Diesel operation makes possible—fuel costs cut 60% to 80%, up-keep costs reduced to a record minimum. And the "Caterpillar" Diesel's versatile, heavy-duty engine—and its sure-traction, wear-resistant tracks—make another difference, raising work production, setting new figures for dependability and stamina. Get the whole story of the SHOW-DOWN from your dealer. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

THESE ARE SHOW-DOWN FACTS:

A contractor on a Florida project reports: "Our four 'Caterpillar' Diesel Tractors are moving 48,000 cu. yds. of sand per 6-day week. All are working 24 hours a day, averaging 83 yds. per hour per tractor on a 500-ft. loaded haul up a steep grade, climbing from 30-ft. cuts to dumps 15 or 20 ft. high."

"At an average fuel cost of only 14½ cents per hour," writes a Connecticut owner, "our 'Caterpillar' Diesel Tractor, equipped with bulldozer, has been handling 2500 cu. yds. of fill material per day."

CATERPILLAR DIESEL



For the Largest and Smallest Jobs

Write for Catalog describing the complete "Conveigh" Line of dependable anti-friction troughing and return idlers, trippers and accessories. They will measure up to the most rigid requirements of the largest as well as the smallest job.

PORTABLE MACHINERY CO.
Division of A. B. Farquhar Co., Limited
BOX C-I, YORK, PA.

The New Jaeger Spreader

New Adjustable Spreader Featured by Easy Pull

A feature of the new adjustable spreader recently announced by the Jaeger Machine Co., 701 Dublin Ave., Columbus, Ohio, is its easy pull, permitting its use with the newer model Ford and Chevrolet trucks as well as with larger models, for laying stone, macadam and bituminous material for both base and top. The main load is carried on 36 x 4-inch steel wheels which operate on the hard surface outside the area of new material. A screed mounted on floating runners which ride the high spots independent of the ups and downs of the wheels is designed to secure smoothness of spread, filling out the irregularities of the subgrade. This spreader will lay gravel, rock, slurry, chert, and hot or cold bituminous mixes to depths of 1 to 10 inches.

Adjustability for 8 to 11-foot widths of spread is built into the machine, eliminating carrying back and hand filling of narrow strips on roads up to 24 feet in width. Provision is made for blending joints by bleeding material from a gate on either side.

New Pipe-Line Aftercooler

An aftercooler of new design has recently been announced by the Ingersoll-Rand Co., 11 Broadway, New York City, for use with air and gas compressors of moderate capacities. The aftercooler is for use in the discharge line in place of a section of the pipe, thereby making the discharge pipe and aftercooler a complete unit.

The compressed air or gas passes through a large number of tubes and is broken into thin streams so as to furnish maximum cooling surface. The cooling water enters at the point of lowest air temperature and flows counter to the flow of air. Spaced Bakelite baffles guide the cooling water across the Muntz air tubes.

At the end of the PL cooler, the velocity of the compressed air is reduced in a moisture-separating chamber which reverses the air flow several times and traps out condensed moisture. Condensate is removed from the air path and can not be picked up again. Due to its compactness, this cooler can be mounted in any position as an integral part of the discharge line.

Copies of the new Bulletin No. 2239 describing this new aftercooler may be secured from the Ingersoll-Rand Co. at the above address by mentioning this magazine.

Bulletin on Maintenance of Stabilized Roads

Since the original bulletin on the maintenance of stabilized roads was issued by the Calcium Chloride Association, much additional information on this subject has been gained. Consequently a revised and more complete bulletin has just been issued, providing an up-to-date source of information on this subject. This new bulletin covers the various phases of stabilized road maintenance thoroughly and concisely, and is well illustrated to show various operations and equipment.

Copies of this Bulletin No. 18 may be secured gratis by state and county highway engineers and contractors by writing to the Calcium Chloride Association, 4145 Penobscot Bldg., Detroit, Mich.

Hough-Universal Road Sweeper Used in Fleets of From Five to Eighteen by 27 State Highway Depts. and by Over 50 Bituminous Paving Contractors.

Powered by its own Engine

Manufactured by

THE FRANK G. HOUGH CO.

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BURCH DUMP BODIES

Balanced power for raising or lowering—automatic locking, any position—one moving part—no gears—no oil lines—no heating or foaming of oil. Plain and Braced Side Bodies —1½ and 2 Yard capacities.

FAST! POWERFUL!

THE BURCH CORP.
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Write for Literature

GOHI and Craftsmanship

TO the inherent qualities of GOHI Pure Iron-Copper Alloy, the longest lasting, low-cost ferrous culvert metal produced, value is added by GOHI fabricators.

Craftsmanship, modern production methods and equipment, skilled artisans and engineers with a deep knowledge and understanding of highway drainage requirements, cooperate to give GOHI Corrugated Pipe exceptional dollars and cents value in more years of life, outstanding performance and the ability to deliver unfailing, uninterrupted trouble-free service.

Your own drainage problems will be best solved by GOHI Corrugated Pipe. Consult any fabricator listed.

GENUINE OPEN HEARTH IRON GOHI TRADE MARK PURE IRON - COPPER ALLOY

Meets copper bearing pure iron requirements in all accepted specifications for corrugated metal culverts.

(57)

GOHI

PRONOUNCED "GO-HIGH" **CORRUGATED PIPE**

New England Bolt Co.	Everett, Mass.
Central Culvert Co.	Ottumwa, Iowa
Capital City Culvert Co.	Madison, Wis.
F. Yeager Bridge & Culvert Works	Port Huron, Mich.
Bancroft & Martin Rolling Mills Co.	S. Portland, Maine
Denver Steel & Iron Works Co.	Denver, Colo.
The Lane Pipe Corporation	Bath, N. Y.
Dixie Culvert Mfg. Co.	Little Rock, Ark.
St. Paul Corrugating Co.	St. Paul, Minn.
The Newport Culvert Co.	Newport, Ky.

GOHI CULVERT MANUFACTURERS, INC., . . . NEWPORT, KY.

Deep Water Cofferdam Kept Tight by Concrete

Columbia Construction Company Used "Blisters" and Concrete on South Cofferdam at Bonneville

By HENRY W. YOUNG

THE south cofferdam for the main dam at Bonneville, for which the Columbia Construction Co. is the contractor, was constructed of timber cribs surrounded by a row of interlocking steel sheet piling. While such crib construction had probably never before been attempted on such a scale and under such severe conditions (at places and at times the river was 60 feet in depth, with velocities up to 12 feet per second), and the job came out remarkably well, nevertheless some leakage was found during the unwatering of the cofferdam area. Especially was this true after the high-water period of June and July, 1935, which inundated the cofferdam to a depth of several feet and it had to be pumped out for the second time.

For the most part, the leaks last fall were under the foot of the steel piling. At such depths, and encountering solid rock at some places and overburden at others, some of the piles did spread out at the foot, due to the footing material and its contour encountered in driving. Water came into these openings and worked along between the sheet piling and the cribs, coming out on the dry side at the first convenient opening.

But as has been the case all along at Bonneville, the U. S. engineers seem to have had almost uncanny foresight. They had looked for something of this nature to happen and were prepared, having taken steps beforehand that would enable them to remedy the trouble, should it arise.

At intervals along the outer face of the steel facing, about every eighth pile in parts where the trouble would be most likely to occur, they had welded a section of piling to the main pile to form a T. This was done at the time of driving. Later, when a leak was located in the main line of pilings, another row was driven to surround that point. This formed in effect a jacket or "blister" on the face of the main cofferdam. This was connected with the main piling, in a water tight joint, by means of two of the T-sections. When the outer jacket was completed, the area thus enclosed was covered to the necessary depth at the pile footings with concrete, poured

Stopping Leaks with Tremie Concrete in the South Cofferdam at Bonneville

through the tremie from a hopper above. Beginning at the T-sections at the ends, the jacket piling was driven out somewhat from the main piling along an easy curve, the width of the pocket being some 3 or 4 feet.

Stabilized Roads Coming Into Their Own

The stabilization of roads, that much-discussed subject of the past year or two, seems to be advancing from the experimental stage to an accepted type of road surface. The following editorial which appeared in *Public Construction News*, the official organ of the Illinois Contractors Association, shows how one group feels about it:

"While surveys are only partially completed at present, first reports indicate that engineers in the highway department have a very wholesome respect for the stabilized surfaces constructed in the last two seasons. In spite of the exceedingly severe winter weather, these surfaces have stood up beyond expectations. So far, but one road has shown signs of base failure and it is reported that it can be repaired at a very nominal expense.

"With the interest shown and the study being made of secondary road surfaces, the experience of the past winter will go a long way toward establishing the position of this type of construction."

New Catalog on Moto-Mixers and Agitators for Concrete

An unusually attractive illustrated catalog, with the new spiral binding, has recently been published by the Chain Belt Co., 1666 W. Bruce St., Milwaukee, Wis., on the Rex line of Moto-Mixers and agitators. The catalog is divided into sections, covering such topics as profits, application of this equipment, users, questions and answers, sizes etc.

Copies of this Catalog No. 280 may be secured by readers of this magazine without obligation by writing direct to the Chain Belt Co.

Williams "DXL" Dragline Bucket

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Stronger

Your crane will handle more earth and less bucket when equipped with a "DXL", built of special alloy steel. We also build Williams Power-Arm, Power-Wheel and Multiple-Rope clamshell buckets. *Write for bulletins.*

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LeRoi Air Compressors are available in all mountings, single or two-stage, portable or stationary. The catalog gives complete information; write for your copy.

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Valve-in-Head Engine offers lower fuel consumption—greater accessibility.

Cooler Air . . . a cooling system of advanced design, perfected by the builder of LeRoi Engines, eliminates overheating.

Spring mounting . . . standard with LeRoi, reduces vibration and assures lower maintenance costs and increased life of the machine.

Engine and Compressor built entirely in the LeRoi plant . . . means centralized responsibility of manufacture.

Typical Farm-to-Market Bridge in Nebraska

(Continued from page 2)

inches into the cap. The floor is 14½ inches thick with a 2-inch crown. Class A concrete was used in the caps and Class AA concrete was used in the floor and for the curbs. The floor was struck off longitudinally with the bridge instead of laterally, furnishing a smoother riding road surface. This was possible because of the shortness of the spans.

The wheel guards, 20 inches high by 13 inches thick at the base and 7 inches thick at the top, have a batter of 1 inch in 10 for the bottom 10 inches, then a 4-inch set back and another batter of 1 inch in 10 to the top.

Quantities

Item	Quantity	Unit Price
Excavation for bridges	25 cubic yards	$ 1.00
Removal of old structure	One	25.00
Treated timber bridge	1.654 B. M.	100.00
Class AA concrete	41.3 cubic yards	15.00
Class A concrete	11.8 cubic yards	18.00
Reinforcing steel for bridges	9,325 pounds	.045
Treated timber piling	702 linear feet	1.00
Structural steel for hand-rail	1,405 pounds	.06
Bid Price		$2,208.23
Adjusted cost		2,182.83

Personnel

The Monarch Engineering Co. of Falls City, Nebr., was the contractor for this structure with Oliver Finney as Superintendent. The writer was Project Engineer for the Nebraska Department of Roads and Irrigation under the direction of C. W. Eubank, District Engineer.

New Dragline Carries An 80-85-Foot Boom

Answering the demands for a dragline with an extra long working range in the 2½ to 3-cubic yard capacity class, the Marion Steam Shovel Co., Marion, Ohio, has announced the Type 39-A clutch-type machine designed especially as a dragline. Equipped with an 85-foot boom it handles the capacity of a 2½-cubic yard Page R. C. bucket or a 3-cubic yard bucket with an 80-foot boom.

The Marion Type 39-A has unusually large, wide spread crawlers providing

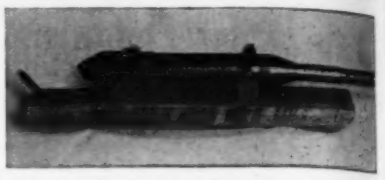
The New Marion Dragline

for very low ground pressure. These crawlers measure 40 inches by 19 feet 9½ inches. They are of the self-cleaning, non-clogging type. Other features include hook rollers to relieve center pin stress, anti-friction bearings throughout and all-welded underframe construction.

Several of these machines are already in the field. Equipped with a 2½-cubic yard bucket, they handle approximately 2,000 cubic yards of material per 8-hour shift. The machine is powered with either a diesel or gas engine. The 39-A follows closely in the steps of the 38-A announced recently. The earlier machine established a dirt moving record for itself of 5,000 cubic yards each 24 hours on the Florida Ship Canal where it had been working three 8-hour shifts each day for several months. This machine also was developed especially for dragline service.

Vibrating Concrete at Forms and Joints

Several state highway departments are now requiring vibration of concrete along transverse joints and side forms. The usual state specifications require this floater to be from 6 to 8 inches wide and from 24 to 36 inches long. The White Mfg. Co., Elkhart, Ind., has de-



The White Vibrator for Use at Expansion Joints

veloped a floater or sled for this purpose for use with White concrete vibrators. After considerable testing this company decided that the most satisfactory floater would be 8 inches wide and 30 inches long made out of 2-inch oak plank. The floater is so arranged that the standard White 3-inch or 2⅜-inch concrete vibrators can be attached to it for horizontal slab vibration and be quickly detached for use as a spade or puddler.

In practice, the floater is pulled across the concrete by a rope attached to one end of the floater and by the flexible driving shaft which is attached to the vibrator head. These vibrators are driven by gasoline engines or electric motors.

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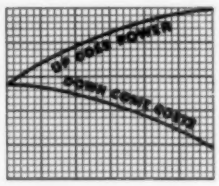

Close-figuring truck users are not overlooking the daily savings that can be made in their haulage costs. They are buying Chevrolets—*the world's thriftiest high-powered trucks!*

New Chevrolet trucks, powered by a High-Compression Valve-in-Head Engine, have the *greatest pulling power* of any trucks in their price range. They use less gas and less oil. Perfected Hydraulic Brakes give unmatched stopping power. The Full-Floating Rear Axle is strong, reliable and efficient. And Chevrolet's 4-Speed truck Transmission provides even starting of heavily loaded trucks.

Every part is built with extra strength—enduring strength—that assures extra long and dependable service with outstanding economy.

Give Chevrolet trucks a trial—with your kind of loads. Learn with what economy Chevrolet trucks will handle your haulage jobs. Your Chevrolet dealer will gladly arrange a test to suit your convenience.

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with increased horsepower, increased torque, greater economy in gas and oil

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with clear-vision instrument panel for safe control

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Any material, in any size from sand to 1 inch stone, is spread evenly in EXACTLY measured amounts - placed exactly where wanted and none scattered along edges. This accuracy is not affected by variations in speed of operation. Saves time and material. Send for complete data.

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BID THE Buckeye WAY
ask for our operation data before you bid

New Earth Dam at Redmont, Ohio

Hamer Bros. Building Dam of Muskingum Conservancy Project with Heavy Equipment Makes Speedy Progress

(Photo on page 40)

THE Piedmont Dam of the Muskingum Conservancy Project is located at Redmont, Ohio, on U. S. 22, on Stillwater Creek. This contract consists of an earth dam 1,740 feet in length and 56 feet high, with a drainage area of 84 square miles. The dam which is on an impervious foundation will impound 31,400 acre-feet of conservancy storage and provide 33,600 acre-feet of flood storage. It will have a saddle type of spillway, with a tunnel outlet, and four 3½ x 7-foot outlet gates.

Hamer Bros. of Greenville, Ohio, was awarded the contract for this project and work started April 27, 1935. The contract includes 174,000 cubic yards of common and 87,400 cubic yards of rock excavation, the construction of a 660-foot tunnel outlet, 804,500 cubic yards of earth embankment and the placing of 7,250 cubic yards of concrete. The contract price for this project is $442,725.00.

The contractor used LeTourneau 30-yard buggies for hauling the strip material, loaded by a Bucyrus-Erie 2½-yard dragline. On a 3,700-foot round trip haul, 250 feet of which was low gear work over a swampy fill, the buggies averaged a complete cycle every 21 minutes. The haul loaded one way required 7.7 minutes, the loading time with the dragline was 8 minutes, dumping and turning time, 1 minute and return time empty in high gear 4.3 minutes.

Work in Borrow Pits

Material from the borrow pits was loaded by 2-yard Bucyrus-Erie diesel shovels to LeTourneau 30-yard buggies, the latter making a 4,000-foot round trip haul in 19 minutes.

For stripping the base of the dam and borrow pits and also for short haul work moving material into the dam, a 12-yard LeTourneau Carryall scraper pulled by a Caterpillar Seventy-Five diesel tractor was used. On a 450-foot haul one way, this scraper averaged 75 trips per 5-hour shift.

Placing Material

For placing material in the dam, the contractor used a Caterpillar Seventy-

And the Dirt Comes Out Here! Material From the Borrow Pit Being Spread on the Dam.

Five diesel tractor equipped with a LeTourneau bulldozer which spread the fill in layers 6 inches deep before rolling. After wetting with hose, the earth was then tamped with two Blaw-Knox sheepsfoot rollers, pulled by Caterpillar Sixties, making six trips over each layer.

The toe trenches and the old stream channel were excavated with dragline machines and the rock fill placed in the trenches from the general excavation.

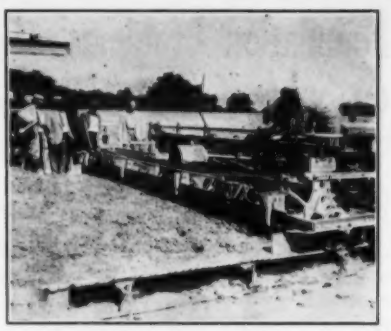
Personnel

The Muskingum Conservancy Project is in charge of Major J. D. Arthur, Jr., Corps of Engineers, U.S.A., as District Engineer, with Theodore T. Knappen as Chief of the Engineering District. The Piedmont Dam is in the Dennison Area, S. M. Baily, Area Engineer and T. D. Oakley, Resident Engineer. R. E. Lee was Superintendent for the contractor, Hamer Bros. of Greenville, Ohio.

Internal Concrete Vibrator Used With Road Finisher

The Erie Contracting & Excavating Co. on a contract in North Benton, Ohio, for a 20-foot concrete pavement used one of the new Flex-Plane internal vibrators running on the same Heltzel steel forms which carried the vibrating finishing machine.

This internal vibrator consists of a rigid transverse frame supported independently on springs and rubber-tired wheels to eliminate the vibration on the steel road forms. The entire frame is vibrated by a mechanical unit. The transverse shaft attached to the frame supports 150 rotating vibrating elements, which penetrate the concrete and move in and out to a depth of 5 inches. The concrete used had a ¼-inch slump.



A Flex-Plane Internal Vibrator on an Ohio Concrete Paving Job

On this job the internal vibrator was followed by a Flex-Plane 20-inch surfacing screed equipped for forward and backward screeding. The same machine installed the longitudinal and transverse contraction joints. This new internal vibrator is made by the Flexible Road Joint Machine Co., Warren, Ohio.

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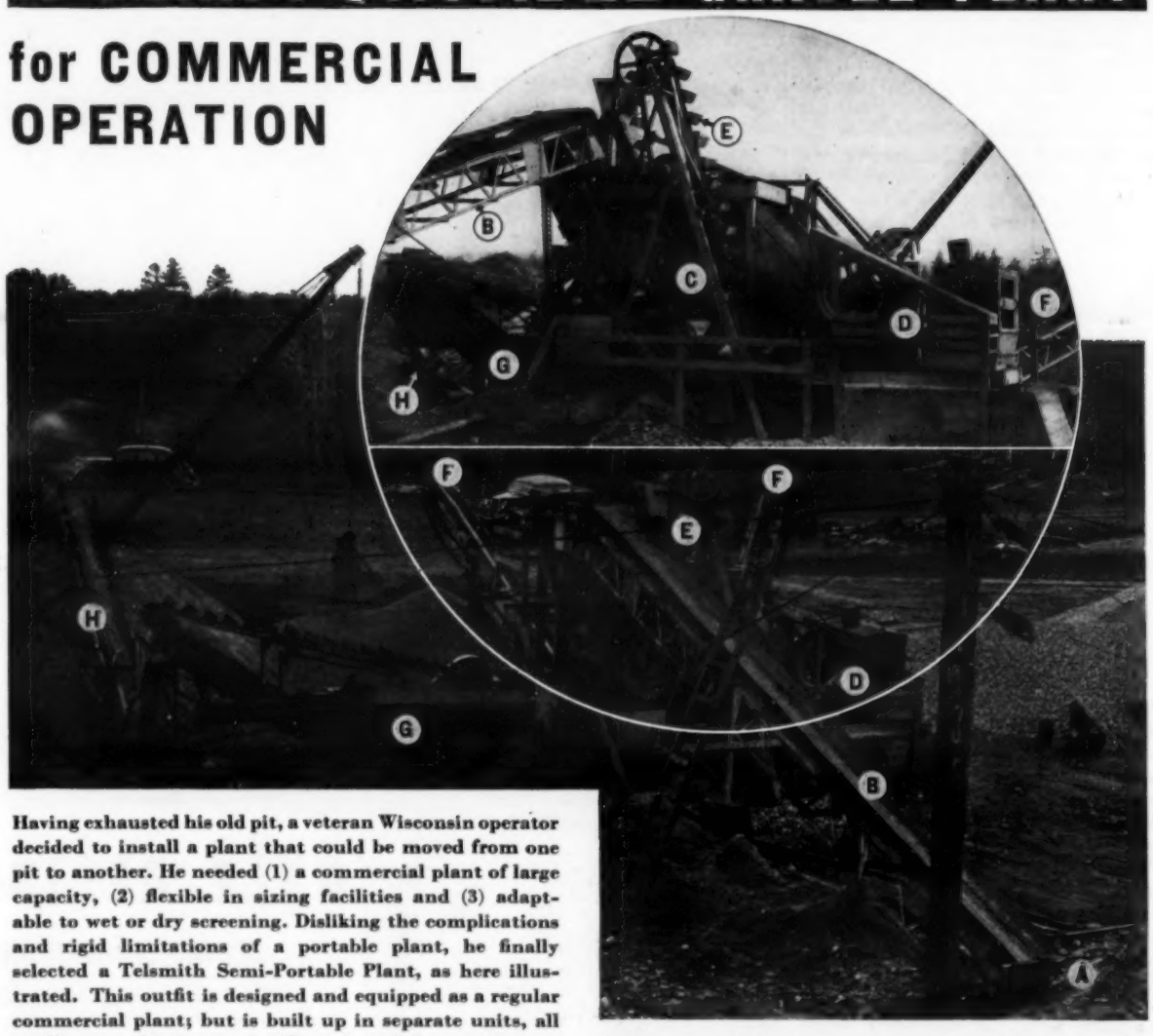

Having exhausted his old pit, a veteran Wisconsin operator decided to install a plant that could be moved from one pit to another. He needed (1) a commercial plant of large capacity, (2) flexible in sizing facilities and (3) adaptable to wet or dry screening. Disliking the complications and rigid limitations of a portable plant, he finally selected a Telsmith Semi-Portable Plant, as here illustrated. This outfit is designed and equipped as a regular commercial plant; but is built up in separate units, all readily movable by truck. No unit weighs over 7 tons. It can be operated as a dry screening plant during cold weather—handles big tonnages—makes three sizes—produces aggregate passing state highway specifications.

Telsmith builds rock crushing and gravel washing plants of all sizes—portable, semi-portable and stationary—varied to suit local conditions. The plant here described is but one example of Telsmith engineering, service and equipment. If interested in semi-portable plants for quarry or gravel plant use, send for Bulletin SG-34, covering semi-portable outfits. Just off the press and chockful of valuable information. No obligation.

A drag scraper brings the pit material to a 20 ft. x 3 ft. 4 in. Telsmith Portable Plate Feeder (A) which delivers to a 20 in. x 42 ft. Telsmith Portable Conveyor (B) discharging on a 3 x 8 Telsmith Triple-Deck Pulsator (C) where the water is added. All oversize goes to a 9 x 30 Telsmith-Wheeling roller bearing Jaw Crusher (D); and, after crushing, is returned to this screen by a Telsmith Chain Elevator (E) with 12 in. buckets. The Pulsator makes two sizes of gravel which are carried to stock piles by two 16 in. x 33 ft. Telsmith Portable Belt Conveyors (F). Water sprays above screen thoroughly rinse the gravel before going to conveyors. Sand passing third deck of screen is flumed to 30 in. x 16 ft. Telsmith Sand Drag (G), which, after scouring and dewatering, discharges to a 16 in. portable conveyor (H) and thence to stock pile. A 65 hp. gas engine with clutch and V-rope drive operates complete plant. Finished products are loaded into railroad cars or trucks by crane with clamshell bucket.

G1-36

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TELSMITH

Foundation Problems on Subway Contracts

(Continued from page 13)

from a commercial mixing plant.

Approach Foundations Altered

A major problem in Contract No. 2 was the changing of the existing bridge approach foundations. In order that the westbound tracks, which are laid on the north side of the bridge, can swing under the bridge approach structure and enter the subway, it was necessary to replace several heavy concrete foundations with steel columns and cross beams.

To transfer the load from the original foundations to the subway steel, two pits were first dug and the final foundations for the subway steel at this point were poured. Two H-columns were erected on each of these foundations and connected overhead with a pair of steel girders extending close to the partially removed original foundations. The load of the approach structure was then transferred to the beams by means of jacks, after which the original foundations were cut off by jackhammers immediately above the girder level. Three steel needles were then set on the girders below the cut-off concrete footing. The jacks were eased off and the load transferred to the girders by the concrete footing that had previously extended to the original foundation. The whole was then concreted in and formed one section of the subway steel under which the westbound tracks pass. The above operation was repeated for each approach foundation that it was necessary to modify. No settlement occurred to the bridge structure which continued to carry a heavy vehicular traffic.

The Fourth Street underpass presented little difficulty, as traffic was interrupted during the entire work. For the subway work on Contract No. 2, 105,000 cubic yards of earth were excavated, 27,000 cubic yards of concrete were poured and 4,700,000 pounds of structural steel erected. Compressed air was supplied by several batteries of portable gas-driven Ingersoll-Rand compressors. In charge of work for the Marcus Contracting Co. was Al Clough, General Superintendent and D. C. Corwin, Chief Engineer. The contract estimate at the time of award was $1,373,999.06.

Terminal Problems

The remainder of the subway work and the construction of two stations was included in Contract No. 3, awarded to the Triest Contracting Corp. This included the construction of 1,333 feet of subway in much the same manner as done on Contract No. 2.

Where the subway swings into the terminal, however, special problems were involved. This final length of subway and terminal lies at the foot of a 20-foot embankment of the Pennsylvania-Reading Railroads. Along this section between the embankment and excavation area, the contractor drove 58-foot Bethlehem interlocking sheet piles. These were set 14 feet below subgrade, using air hammers operated from extension booms on Koehring cranes.

In contrast to the Marcus Contracting Co. who constructed continuous timber guides for the sheet piling, the Triest Co. used several movable timber frames that could be picked up bodily and set wherever needed. First a 10-foot trench was excavated and lined with timber sheeting set in heavy H-columns. Then the guide frames were suspended in this trench by turnbuckles and held in correct alignment by jacks. When the piles were in place, an entire frame could be lifted out and moved to the next section.

As the excavation proceeded along the railroad embankment between the rows of sheet piling, 24-inch steel cross beams were bolted to opposite H-columns, and precast rangers inserted between the sheet piling and the inside H-columns. At the lower levels double 4 x 12-inch cross struts were inserted to take up the side thrust. After the first open cut with a Koehring shovel, excavation was carried on with clamshell buckets operated from Koehring cranes along the side of the cut. Mack trucks removed the spoil.

A concrete mat was next poured, containing 10-inch cast iron track drains. Above this, foundations were poured and the subway steel erected. The precast rangers were then wedged from the permanent columns and the temporary H-columns removed. The concrete walls and roof were poured as in the other Camden contract, using ready-mixed concrete.

A heavy steel frame with very rigid corners was used to carry the thrust from the embankment to the floor, as much of the far side was occupied by open basements. The side columns of the frames were extended up to the track level on the embankment side and encased with concrete to form a retaining wall which replaced the old masonry wall previously existing about 8 feet further out from the tracks.

Service on the near track was discontinued during this construction. It was also necessary to place the heavy line of overhead cables along the shoulder in a temporary conduit.

Contract No. 3 called for the excavation of 65,000 cubic yards of earth, the pouring of 17,500 cubic yards of concrete, the erection of 6,500,000 pounds of structural steel and the driving of 1,500 tons of steel sheet piling. Estimate at the time of award was $957,694. Compressed air was distributed over the job from a central compressor station, using two electrically-driven compressors. In charge of the work for the Triest Contracting Corp. was John L. Hogan, Chief Engineer and Jake Siebert, General Superintendent.

Personnel

Modjeski, Masters and Case, Inc., designers of the bridge, are the engineers for the Joint Commission, being represented on the job by Montgomery B. Case. The Engineer of Design for the Commission is Stephen Harris and C. L. Appleton is Construction Engineer.

CONTROL MAKES THE DIFFERENCE
ONLY ALLIS-CHALMERS GI
CONTROLLED IGNITION
In the Controlled Ignition Oil Tractor, Diesel fuel oil is injected into the combustion chamber at 60° before top dead center—which provides ample time for thorough mixing with the air. At exactly the proper point, this mixture is ignited with a spark. Because the ignition point is controlled—there is no danger or chance of power-wasting pre-ignition. This improved system is not dependent on split-hair adjustments; the vibration problem is eliminated; heavy, unbalanced parts are unnecessary; power and weight are balanced for maximum performance. Only the Controlled Ignition Oil Tractor has these advantages.
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Long Single-Span Bridge Completed in Africa

The longest single-span bridge in Africa and the third longest in the world has recently been opened, according to a United Press dispatch from Bulawayo, Southern Rhodesia. It crosses the Sabi River and is 1,080 feet long, its single arch rising to a height of 280 feet. Fifteen hundred tons of steel was used in its construction.

The bridge, work on which was started in April, 1934, is the gift of the trustees of the late Alfred Beit and has been named the Birchenough Bridge in recognition of the services to the country of Sir Henry Birchenough, chairman of the Beit Trustees and president of the British South Africa Co.

The completion of the bridge gives to the people of the eastern districts of Rhodesia access across the Sabi River to the central districts and will also open up to visitors from the Union of South Africa and tourists some of the most beautiful mountain country in the territory.

A New Duplex Hose

A new type of rubber tubing or hose especially designed for welding equipment and similar services has been put on the market by the Electric Hose & Rubber Co., Wilmington, Del. This Supero Siameez hose consists of twin hose simultaneously molded with a connecting web between them, so that a cross section resembles the figure 8. A single length of this non-kinking hose can be used for equipment which heretofore required two separate lengths. It is also possible to use differing pressure in each side without torque or writhing.

The Supero construction, with a special cord-wound reinforcement between the first and second braid, gives it a high burst limit. With the ¼-inch size, the burst is 2,000 pounds.

Supero Siameez hose is made with the individual hose in different colors or with both hose lines the same color. The connecting web may be cut down the distance required for attaching hose to separate outlets.

Blasting Restricted on Indiana Job

(Continued from page 7)

place or over the end of the fill with equal facility.

On the earth fills an Ateco hydraulic scraper with a roller attached was used. As Indiana specifications require discing of earth fills, a 2-gang disc was pulled behind the roller, completing the operation in one trip. The fills were bladed over to final rough grade with a Caterpillar 12-foot blade pulled by one of the Sixties. All fills were made with 2 to 1 slopes, rock cuts ¼ to 1 and earth cuts 1½ to 1 slopes. The ditches were made 4 feet wide with 3 to 1 slopes.

The second largest cut, ½ mile from Oolitic, required the removal of 32,000 yards of rock and earth, was 1,100 feet long and had a maximum depth of 23 feet. Between the two large cuts was a 20-foot fill 2,600 feet long.

Concrete Paving

This contract included surfacing with a 22-foot wide concrete pavement of 9-6-9-inch section with 10-foot shoulders on both sides and in rock cuts 7-foot shoulders. The pavement will be 36 feet wide in Oolitic and there will be an 18-foot section on State Highway 54. The slab has a 1½-inch crown and wire mesh reinforcement.

The concrete pavement was constructed with ¾-inch transverse expansion joints, of the air-space type with cork cap, every 80 feet and a ⅜-inch cut contraction joint placed half-way between the expansion joints and filled with premoulded joint material. The load transfer at the expansion joints was provided by 3 x 2½ x ¼-inch angles across the bottom of the joints and at the contraction joints by ¾-inch round steel dowel bars 24 inches long and spaced 12 inches on centers.

The Work Day

The contractor worked a 14-hour day in two shifts from 5 A.M. to 12 Noon and 12 Noon to 7 P.M. Thus in four days the laborer was theoretically able to earn within 2 hours of his maximum allowable wage. This left the fifth and sixth days for making up the time lost through weather and from other causes.

Personnel

The contract was awarded to the Calumet Paving Co. of Gary, Ind. for the sum of approximately $240,000 including grading and reinforced concrete paving for the 4.1 miles. For the contractor the work was under the direction of George Verplank, Superintendent. W. J. Heard was Project Engineer for the State Highway Commission of Indiana.

New Cutting Attachment Announced by Linde

A new oxy-acetylene cutting attachment known as the Oxweld Type CW-22 has recently been announced by the Linde Air Products Co., 30 E. 42nd St., New York City. This new attachment possesses a range and kind of performance which permit it to handle light sheet metal as well as all but the heaviest work at speeds and efficiency equal to those of the full-size cutting blowpipe. The attachment operates on low-pressure or medium-pressure acetylene.

The Type CW-22 can be used on either the Oxweld Type W-17 or W-22 welding blowpipe handle, thereby extending the usefulness of these two models. The body and head of the CW-22 are designed to combine strength and lightness, the body being of pressure-forged bronze while the head is a manganese bronze forging.

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CONTROLLED INJECTION OF FUEL

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Just the right amount of air for efficient combustion of fuel at *all* loads and *all* speeds. Correct air-fuel ratio *eliminates* an excess of air at idle speed — which would lower exhaust temperatures *at the expense of power.*

Now you can have fuel economy without the handicaps of high compression ignition. Now you can burn low cost Diesel fuel oil and—*in the same tractor*—you can enjoy the advantages of simple, instant starting... easy, inexpensive servicing... unexcelled lugging ability... freedom from vibration "whip"... without heavy, expensive parts and hair-line adjustments. All this at low first cost and unequalled economy of operation. Only the A-C CONTROLLED IGNITION OIL TRACTOR gives you this combination of vital advantages.

WHAT PERCENTAGE OF YOUR DOLLAR GOES FOR LAY-UP LOSSES?

The larger and more expensive your tractor — the greater your loss per hour when the tractor is down for repairs. Allis-Chalmers tractors reduce lay-up losses in two ways: (1) Lower investment per tractor (2) Controlled Ignition assures dependable performance.

Picks and Shovels

(Continued from page 1)

took over the active management of the business on the death of her husband, seems to find nothing unusual in the fact that she is almost a unique figure in her particular sphere of business. When the emergency arose, there was, to her mind, nothing else to do but "carry on."

At the risk of incurring the wrath of all the old "die-hards" who still maintain that woman's place is in the home (and we can't help feeling that such an attitude is fostered by a secret masculine fear that women might outdo them at their own game), this old hat goes into the air for these feminine pioneers, not because they are women but because as individuals and contractors they have successfully carried on their jobs in the face of many obstacles, not only the usual ones any contractor has to overcome but, in addition, the added obstacles forced on them by convention and tradition because they happen to be women in "a man's world."

A New Disc Spreader for Road Work

The Differential disc spreader, recently announced by the Universal Crane Co., Lorain, Ohio, is designed for spreading dust or screenings for first and second binder courses and for spreading chips for top dressing in new road construction; for resurfacing, patching, spreading dust-laying chemicals and building up shoulders in road maintenance; and for spreading sand, cinders, salt or calcium chloride on icy highways.

The unit which is mounted on two wheels is easily attached to a truck. The ample length of the spreader hopper, plus an adjustable leveling device enables speedy attachment to various chassis heights and widths, permitting the use of this unit with practically any dump truck suitable to this class of road work.

The whirling disc which distributes dust or screenings uniformly and at a proper angle to penetrate into the voids, is powered by a differential of standard automotive rear axle design. All gears run in lubricant. The unit is equipped with interchangeable discs of different diameters and surfaces for various materials. The flow of material onto the disc is controlled by a single hand lever, actuating an adjustable gate opening. Auxiliary baffle plates on the sides aid in the control of the width of spread. A hinged apron on the front fits against the truck to prevent spilling of material.

The width of spread varies from 4 to 30 feet, under constant control, and from 0 to 100 pounds per square yard can be distributed, depending on the width of the spread.

Minnesota Counties Use Creosoted Structures

Many counties in Minnesota are building pressure creosoted wood bridges of good design, in which care is taken to frame the material before treatment, according to a recent report in *Wood Preserving News.*

One example is that of a bridge between Rice and Le Sueur Counties. This is a single span structure 32 feet long and 24 feet wide, with abutment bents of six piles each, 12 x 12-inch x 28-foot caps, 10 lines of 6 x 24-inch x 32-foot stringers, and a 2 x 4-inch laminated floor. A clay-bound gravel wearing surface was placed on the floor to match the approaches to the bridge and to protect the floor from wear. This surface is retained in 4 x 8-inch scupper blocks, laid flat. The felloe guards are 8 x 8-inch timbers, secured by bolts passing through the stringers, floor, and scupper blocks. The hand-rail consists of 6 x 6-inch posts which carry a single 4 x 8-inch rail. All backing pieces are 3 x 12-inch plank. The tops of the wings are sloped and covered with a 3 x 12-inch plate.

A grade of Douglas fir with a bending strength of 1,600 pounds per square inch was required for the stringers. In general, lower stress grades were specified for the other members.

All material with the exception of hand-rail and posts was pressure creosoted by an empty-cell process to retain 10 pounds of Grade One coal-tar creosote per cubic foot. All creosoted lumber and timbers were cut to length, framed, and as far as practicable, bored for bolt holes before they were treated.

E. J. Stahl of Faribault is County Engineer for Rice County and Edwin P. Meyer of Le Center is Engineer of Le Sueur County.

"YES, SIR"

It does a fine job!! What? The FLEX-PLANE Finishing Machine. You see, it screeds backward, as well as forward, and the screed is 20" wide and it irons out a beautiful surface. It is leased or sold. FLEX-PLANE Dowel Rod Spotters are good too, and FLEX-PLANE Joint Installers are known throughout the Universe as a good means to control cracking.

FLEXIBLE ROAD JOINT MACHINE CO.
WARREN, OHIO

BUILT FOR DAY AFTER DAY PERFORMANCE

Strength—the ability to take the battering shocks and strains of heavy construction work—is an outstanding characteristic of all Le Tourneau equipment. This strength is achieved by the use of special high-tensile, alloy steels—made to exacting Le Tourneau specifications—and electric arc welding—there are no castings, no rivets to work loose or shear off. As a result, Le Tourneau construction is stout and rigid, stands up, repairs are few and easily made, equipment life is prolonged, maintenance costs are extremely low, and big, hourly yardages are delivered steadily day after day.

Ask your "Caterpillar" tractor dealer what this ruggedly-built, job-proved equipment is doing for owners the country over. Buy proved equipment—Le Tourneau equipment.

R. G. LE TOURNEAU, INC.
Peoria, Illinois — Stockton, California
Cable Address: "Bobletorno"

MANUFACTURERS OF: ANGLEDOZERS, BUGGIES, BULLDOZERS, CARRYALL SCRAPERS, CRANES, DRAG SCRAPERS, POWER CONTROL UNITS, ROOTERS, SEMI-TRAILERS.

LETOURNEAU

In the Blue Ridge Mountains—It takes stout equipment to consistently handle loads like this one on a job in the mountains of North Carolina.

Job Handyman

Le Tourneau Cranes will cheaply and quickly handle a multitude of tasks from loading and unloading equipment to the placement of heavy timbers and culverts. They are made in three boom lengths, 20, 30 and 40-foot—for all size tractors and are operated by means of Le Tourneau Power Control Units.

Sure It's Easy!—The Le Tourneau Crane picks up an 8-Yard Carryall, weighing 11,500 pounds, and puts it on a flat car.

SAUERMAN LONG RANGE MACHINES

POWER DRAG SCRAPERS
SLACKLINE CABLEWAYS
SLACKLINE SCRAPERS
TAUTLINE CABLEWAYS
SCRAPER LOADERS

If you have a problem of digging, conveying or stockpiling earth, clay, ore or bulk materials, write for the Sauerman catalog.

SAUERMAN BROS.
464 S. Clinton St., CHICAGO

Treating Base Soils for Heavier Traffic

Subterranean and Road-Plant-Mix Treatments Tried Experimentally by Missouri Road Dept.

THE problem: a large mileage of earth roads and worn out gravel and crushed stone roads of little thickness to be improved to give dustless, safe service to present and future traffic at a reasonable annual cost, including maintenance expenditures. Missouri has been doing some preliminary experimental work which was discussed by F. V. Reagel, Engineer of Materials, Missouri State Highway Department, at the Thirty-third Annual Convention of the American Road Builders' Association. He asks the question, "Can we add sufficient oil to a sufficient thickness of base to waterproof durably without inducing a plastic condition and thereby losing the inherent stability of the soil? If not, can the plasticity so induced be overcome by the addition of an economical amount of friction material?"

Subterranean Application Method

The Ingles or subterranean method was the first used in Missouri. By this method a quantity of liquid bituminous material or other treating agent is deposited at the bottom of a scarified layer of earth, or earth covered with granular surfacing, followed by compaction to permit the oil to permeate upward and diffuse through the mass. This method was first tried in Missouri by Alex F. Sachs, County Engineer of Jackson County, on short stretches of earth, and earth covered with crushed stone surfacing. After promising indications were observed on these stretches constructed during the summer of 1935, 10 miles of experimental sections were constructed on the Missouri State Highway system in Platte County.

The method as now developed consists essentially of scarifying the existing roadway to a depth of 4 or 5 inches, followed by the introduction of the bituminous material with or without the prior or subsequent application of a small amount of water or soap solution to promote a beneficial chemical action between the oil and soil surfaces. Following the application, the roadway is kept smooth under traffic and rolled if necessary to obtain the desired compaction.

The equipment for application consists of a heavy frame supporting hollow curved teeth which project down to the desired depth and through which the bituminous material from an accompanying distributor is forced by means of a pump mounted on the rear of the applicator.

In the bituminous material added are included SC oils, MC oils, MC oils emulsified, and commercial emulsions. The quantities vary from approximately 3 to 7 per cent of oil by weight of the layer treated, based on the material passing a 40-mesh sieve and the 100-penetration residue of the treating oil. These quantities attempt to bracket the optimum quantity or, in other words, to obtain some sections too lean and some too rich in order to obtain the maximum of information.

Aggregate Added to Stabilize Soil

To a number of sections varying quantities of aggregate were added prior to scarification in order to test the efficiency of additional friction material in case too great a degree of plasticity was induced and also to check the relative efficiency from an economical viewpoint. The ranges of percentages of the material passing the 40-mesh sieve on the completed sections approximated 20 to 30 per cent, 50 to 60 per cent and 100 per cent. It seems to take about two to three weeks for the oil to permeate the mass, the final stage of diffusion seeming often to follow a rain.

The final result sought is a waterproofed layer from 4 to 5 inches in thickness. All granular material present in the surface seems to be well absorbed with the exception of a very small quantity of floating material. The final result is a base and not a surface but it is hoped that the base obtained, at a cost of approximately $2,500 per mile, will require only a light armor-coat as a surface, the resulting combination, if successful, being obtained at a considerably reduced cost as compared to other types of low cost construction in Missouri, particularly in areas where aggregates are not readily available.

The project was constructed in the late fall during a rainy season and under conditions which were considered as distinctly unfavorable. Some sections, particularly those having little or no granular material present, have probably not yet had a complete drying action such as would be necessary for the best results. The lateness of the season prevented application of trial sections of surface and consequently the base has been exposed to traffic throughout the past winter without surface protection. It has showed little, if any distress, carrying traffic throughout its en-

(Continued on page 28)

STERLING HOISTS
Timken Bearing Equipped
Johns-Manville Asbestos Frictions
High Carbon Ground Precision Shafts
Improved Screw Thrust with Positive Clutch Release
Write for complete catalog.
STERLING MACHINERY CORP.
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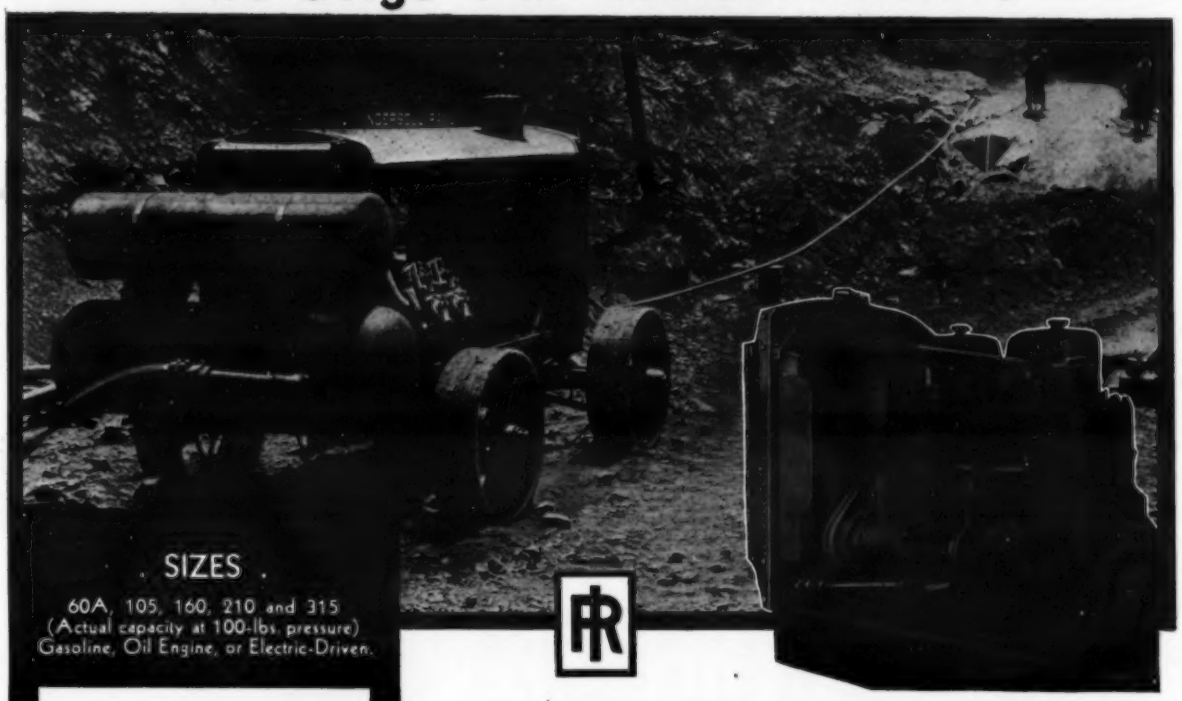
Fire Proof—Oil Burning
Hand and Motor driven spray. Many sizes. Write for catalog.
White Mfg. Co.
ELKHART INDIANA

You Get An Independent Engine Cooling System with the Two-Stage Air-Cooled Portable



. SIZES .
60A, 105, 160, 210 and 315
(Actual capacity at 100-lbs. pressure)
Gasoline, Oil Engine, or Electric-Driven.

(The second of a series of five advertisements).

1. Air-Cooled Compressors
2. **Independent Cooling Systems**
3. "Constant Level" Lubrication
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Units Less Running Gear,
Steel Wheels, Solid Rubber Tires,
Pneumatic Tires, I-R Trailer,
Two-Wheel Trailer,
Motor Truck Mounted.

The engine of a portable compressor to operate efficiently should be kept at a temperature of about 180° F., which means hot water in the jackets. Water at or near this temperature is too hot for efficient compressor cooling.

With the I-R Two-Stage Portable, water is used for cooling the engine and air for cooling the compressor, each of which performs its own duty correctly and represents the most efficient method for the purpose intended.

These independent cooling systems allow maximum operating efficiency of both the engine and compressor at all times.

A sectionalized engine radiator is used, having a removable guard and a radiator curtain. A dial thermometer in the radiator top tank indicates the engine cooling water temperature, and serves to guide the operator in positioning the curtain.

Write for catalog 3164 today.

Ingersoll-Rand
11 BROADWAY. NEW YORK, N. Y.
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Wellpoints Speed Work on Mass. Sewage Plant

Construction of Hopper Tank 18 Feet Below Water Level Aided By Wellpoint System

By EDMUND J. MacDONALD
John MacDonald Construction Co.,
Newton, Mass.

WORK on the construction of an Imhoff tank at the sewage treatment plant for the town of Milford, Mass., was started by the John MacDonald Construction Co., of Newton, Mass., contractor for the project, on February 5, 1936, in the midst of a spell of extremely cold weather.

The bottom of the tank is hopper-shaped, sloped four ways, 1 on 2, and at Elev. 225, while the ground water level at that spot is at Elev. 243, necessitating lowering the water level 18 feet. Accordingly, the first operation consisted of the installation of a Griffin wellpoint system of Jet N' Drive wellpoints. The header pipe was laid at ground water level and the points were sunk in the clay and fine sand in laminated strata in which we had to work.

Because of the severe cold during February, we did no more than keep the water approximately 12 feet below its original level but on February 29 the pumps were run at full speed, holding about 27 inches of vacuum, and on Monday, March 2, the water was lowered below the subgrade. The water pumped contained about 2 per cent solid matter, some of which was fine enough to pass through the 200-mesh screen, which gave a cloudy effluent. It was then a simple matter to place the forms for the bottom of the tank and pour the concrete, which was completed in two days.

Wellpoints Save Time

About eleven years ago a tank of the same type and size was installed at the same location without the use of wellpoints at a cost of approximately four times our price and at a loss to the contractor. It then took eight months to complete what we accomplished in about a month.

There is one point to be stressed, however, in the installation of a wellpoint system and that is that they can not be installed in extremely cold weather and be 100 per cent efficient, and our experience has proved that one of the most essential parts of the job is the proper installation.

With the Header Pipe at Ground Water Level, This Ring of Wellpoints Kept the Imhoff Tank Excavation Dry

Dealer Holds Open House in New Building in Chicago

S. G. McAllister, President of the International Harvester Co., was the guest of honor at the Open House held recently by the Tractor & Equipment Co. of Chicago, to celebrate the opening of the company's new building at 433 South Jefferson Street. With a dozen or so other officials of the company and the many guests present, Mr. McAllister inspected the $100,000 display of International industrial tractors and construction machinery.

Movies of Snow Plows Shown at Luncheon for Press

Motion pictures of the operation of Walter snow fighters during the past severe winter were shown at a luncheon on April 21 given by the Walter Motor Truck Co., Ridgewood, L. I., N. Y., for newspaper men of the New York Metropolitan area.

A variety of shots taken by dealers in various sections of New York State showed how the plows opened roads ordinarily blocked for months. A short address by L. G. Stelzle, President of the company, preceded the motion pictures.

The divided lane highway was advocated because it would provide greater motoring safety. A glance at the daily newspaper confirms the deadliness of the head-on collision.

—*J. D. Adams, Chairman, Indiana State Highway Commission*

PAGE AUTOMATICS . . .
Speed up Dragline Work 15% to 25%

One AUTOMATIC owner writes:
*"We are stripping a 25-foot overburden, some of which is hardpan and rock. We had another make bucket on this machine prior to buying the Page AUTOMATIC, and can truthfully say that since putting on the AUTOMATIC, we are stripping at least 50% more material."
*From a letter in our files.

You also can speed up your dragline work —and increase yardage with a patented rounded front AUTOMATIC. Learn about the distinct digging advantages of this Page bucket NOW! See your equipment dealer —or write us direct. Free Bulletin "THE AUTOMATIC" sent on request. Address Dept. "N."

". . . DIG WITH A PAGE AUTOMATIC"

BUILT IN SIZES 3/8 TO 15 CUBIC YARDS

PAGE ENGINEERING COMPANY • CLEARING POST OFFICE CHICAGO, ILLINOIS

HELTZEL STEEL FORMS

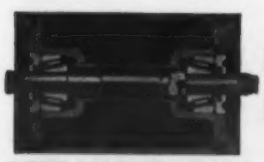
Write for Bulletin 101

For any type of concrete construction; foremost in strength, service and economy—permanently true to line—easy to handle and clean, meeting any highway specifications.

Illustration shows Curb-and-Gutter form with double radius face form. Insert shows skeleton face-rail support. Each rail securely locked in place, being keyed to the stakes. The division plates support front and back rails their full depth, and can be removed without disturbing concrete or side rails.

Write for Bulletin 200

THE HELTZEL STEEL FORM & IRON CO., WARREN, OHIO



Adjustable bearings locked into pulleys take radial and thrust loads. Furnished with either Ball or Roller Bearings.

"CONWEIGH" Trougher No. 25

Conweigh presents an advanced design which provides the ultimate in economy performance and service . . . Write for new Catalog describing the complete Conweigh Line . . . Our line of Portable and Semi Portable Conveying equipment is described in our Catalog of "Portable Conveyors."

PORTABLE MACHINERY CO.
Division of A. B. Farquhar Co., Limited
BOX C-1, YORK, PA.

Deep Sidehill Cut in Western Iowa

Shirley Construction Co. Moves 250,000 Cubic Yards on 1.9-Mile Project and Makes 60-Foot Cut in Two Lifts

(Photo on page 40)

A 1.9-MILE grading project through the eastern section of Council Bluffs, Iowa, made necessary the handling of 250,473 cubic yards of material in two deep cuts and for the approaches to two railroad bridges. The approach to the Chicago, Great Western Railroad bridge accounted for 87,000 yards and the approach to the Rock Island and Chicago, Milwaukee, St. Paul & Pacific bridge required handling 56,000 yards. The Shirley Construction Co. of Omaha, Nebr., was the contractor for the grading of this project NRH-280.

Two large cuts of similar character were the features of the work. One about ¼ mile from the west end was 60 feet deep and required handling in two lifts. A Northwest 1½-yard shovel was sent around the face of the sidehill cut, making a cut just sufficient to allow the shovel to move around. Then on the return trip the shovel made a 30-foot sidehill cut, casting part of the material and the remainder being hauled to fill close by. To make this first cut it was necessary for the shovel to climb a 30 per cent grade.

Handling the earth from the shovel were two Euclid and two LaPlant-Choate 7-8-yard crawler wagons with Caterpillar Sixties for hauling. On the maximum haul of 1,500 feet the contractor used as many as eleven wagons.

A Sixty tractor with a Euclid bulldozer was used to rough in the fills in 12-inch lifts and a Caterpillar 12-foot blade was used for leveling off before rolling with a J. I. Case tractor with concrete filled wheels. The wind-blown sand which comprises the soil of this area compacts very hard under rolling with even a small amount of moisture in the material.

A small yardage was handled with a Northwest dragline using a 1½-yard Omaha bucket. This machine also was used for the borrow from adjacent property where the deficiency in material occurred.

The cuts were of practically vertical face as the material stands perfectly except where there were a few pockets of coarse sand and in several places the bank sloughed off or caved and the material had to be removed from the right-of-way. Federal specifications require that the top and bottom of all vertical face cuts be rounded on a 5-foot radius with hand labor. This adds an element of finish to the work not usually seen on earlier cuts of this nature.

Personnel

This work of the Shirley Construction Co. of Omaha, Nebr., was done with N. R. Friets as Superintendent. Virgil Butler was Resident Engineer for the Iowa State Highway Commission.

There is no attempt at public works by the Federal government that has given the people more for their money than the building of highways. And this form of internal improvement is one that reaches all sections of the country and helps practically everybody to some extent. In times of economic crisis, such as we have been going through, where the general taxpayer must pay for relief and public works, the highways present one of the best outlets for relief labor.

—*The Willmar Tribune*

C. & E. M. Photo

Loading Dirt on the Second Lift of a 60-Foot Sidehill Cut

New Catalog on Compressors

A new bulletin on Unitair compressors has recently been announced by the Sullivan Machinery Co., Dept. 21, Michigan City, Ind. The Unitair is a two-stage completely air-cooled V-type single acting stationary compressor. It can be easily and quickly installed, operates on little foundation and is designed for twenty-four hour service.

These compressors are available in four sizes up to 400-cfm displacement and for any kind of drive: built-in electric motor, direct connection or V-belt drive from motors and gasoline, distillate or diesel power units.

Copies of this Bulletin 88-0 may be secured by writing direct to the Sullivan Machinery Co. at the above address.

Safety Featured in Booklet Just Issued by Truck Co.

Safety is the theme of a new 24-page illustrated booklet just published by the Four Wheel Drive Auto Co., Clintonville, Wis. Graphically the story of automotive safety is brought to the reader, statistics on 1935 highway accidents are included and the causes of such are shown in a clear, forceful manner.

In addition the safety features of FWD trucks for all types of hauling are described, the major factor being, according to the manufacturer, FWD controlled power.

Free copies of this booklet may be secured direct from the FWD company by interested contractors, engineers, highway department officials and truck operators by writing to the company and mentioning CONTRACTORS AND ENGINEERS MONTHLY.

THE FAMOUS
GIANTGRIP T
STRAIGHTEDGE
Either Steel or Aluminum
Formed straight under tremendous pressure on tubemill presses, it STAYS straight.
Two usable edges:—one sharp-cornered and squared for scraping; the other rounded for line-point straightedging. *Write for circular.*
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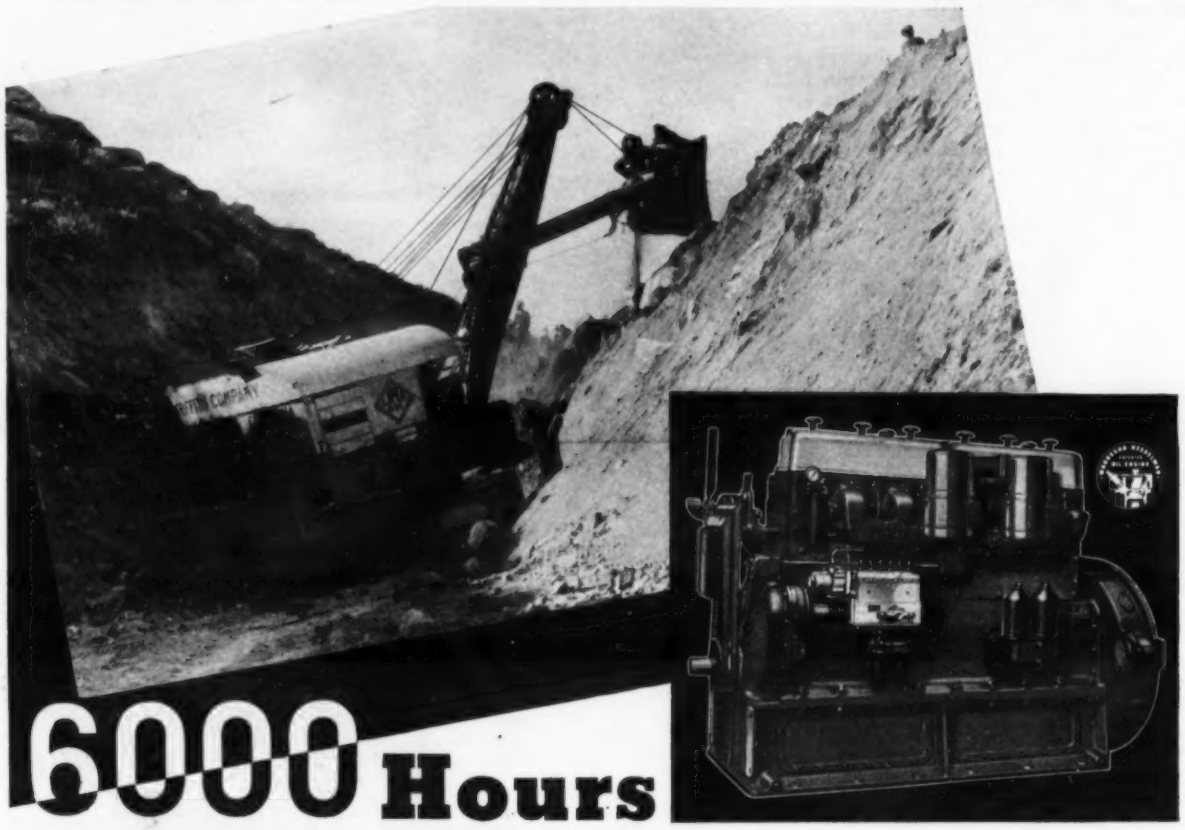


6000 Hours
of Economical Performance
without overhauling . . . . . .

The Los Angeles Aqueduct will bring water from Boulder Dam to the City of Los Angeles. Rock was being moved here by a 2-yard Lima Shovel with a 2½-yard bucket. Starting on January first, 1935, this shovel ran three seven-hour shifts daily, thirteen days out of every fourteen, for a total of 1253 hours. It was then converted to a dragline and continued operation with a 3-yard bucket, running two eight-hour shifts a day for a total of 1152 hours. It was a grueling test during the entire time lasting from January 1st, 1935 to May 31, 1935. Its fuel was "California 27 fuel oil" bought at an average cost of 26 cents per hour. Lubricating oil cost 1 cent per hour. The power plant, a six-cylinder ELH Waukesha-Hesselman Oil Engine, has given, to date, 6000 hours of almost continuous performance. The only major maintenance was a valve grind after 2200 hours of service, until a general overhaul was ordered after 6000 hours of heavy duty.

This Hesselman Engine delivers 150-160 horsepower, and is designed for heavy-duty service in shovels, hoists, draglines, portable and semi-portable construction machinery as well as for heavy stationary power service.

Hesselman Engines are easy to start; they burn modern high speed Diesel fuels; and their upkeep is low because they work at moderate pressures. This engine was the outstanding feature of the 1936 Road Show.

Write for Bulletin No. 918—*Waukesha Motor Company, Waukesha, Wisconsin.*

WAUKESHA ENGINES

Cotton is Fashion In Roads This Season

(Continued from page 8)

square yard, to protect it from damage by the wheels of the distributor.

It is recognized that there are a number of different methods of applying the surface treatment. Therefore, in this program, the method generally favored by the state highway department concerned will be acceptable, except that any method involving the mixing of the bitumen and aggregate on the road surface will not be suitable since the fabric would likely be displaced and damaged.

Each project must contain not less than four sections, each section having a length of not less than ½-mile and preferably not less than a mile, constructed in a location where the base course, subgrade and drainage conditions are as nearly uniform as possible. On three of the sections, the surface treatment should be reinforced; one section being reinforced with Type A fabric, having 12 threads per inch both warp and filling, the second Type B with 9 threads and the third Type C with 7 threads. The fourth section should have exactly the same surface treatment but will contain no fabric reinforcement.

While it is desirable that each project shall contain at least four sections, there is no objection to having more. Where subgrade and base conditions are not reasonably uniform, a greater number would be desirable. In such cases the projects should be planned so that adequate comparisons may be made between reinforced and non-reinforced treatments. For example, if a portion of the project has a good base and another portion a relatively poor one, the sections should be so arranged that comparisons may be made between reinforced and non-reinforced treatments on the good base and also between the two types on the poor base.

It is desired to obtain from the projects constructed under this program as much accurate information as possible on the service of reinforced treatments as compared with non-reinforced treatments, under comparable conditions, and also the costs of construction and maintenance. To this end, state highway departments making requests for supplies of fabric should indicate that it is for use in experimental road construction; that the projects will be distributed in the state to give information on the utility of fabric reinforcement under various conditions; that the individual projects will be planned, insofar as practicable, in accordance with the general instructions given above; and that reports will be made to the Bureau of Public Roads; and that the project will be given a careful condition inspection at least once every six months.

Many States Cooperate

Eighteen states have now applied for quantities of cotton reinforcing fabric to be furnished gratis by the Department of Agriculture in this experiment.

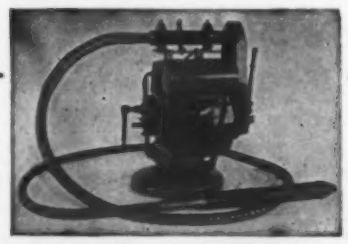
Among the eighteen states, New Jersey will build 50 miles of cotton roads this summer; North Carolina, 100 miles; South Carolina, 50 miles; Michigan, 34 miles; Indiana, 25 miles; Texas, 50 miles; Georgia, 50 miles; and Alabama, 100 miles. Other states which have included an as yet undetermined mileage of cotton road in 1936 road building programs are Mississippi, Minnesota, New York, Illinois, Nevada, North Dakota, Massachusetts, Connecticut and Rhode Island.

New York's first cotton road construction may be undertaken in Suffolk County on Long Island as the result of the recent inspection of a New Jersey cotton road built two years ago by county and township highway officials. Notwithstanding the fact that it has been subjected to extremes of weather, including two unusually severe winters and heavy traffic, this section of cotton reinforced road in New Jersey was found in practically perfect condition while adjacent un-reinforced sections had badly cracked and raveled, requiring considerable maintenance.

As this goes to press, the Cotton-Textile Institute informs us that requisitions for the cotton fabric membrane are being received in such volume that the available allotment may be exhausted before many states have made application.

Personnel Changes for Kesl

There have been two changes in the personnel of the Joseph Kesl Tractor & Equipment Co., distributor of contractors and industrial supplies and equipment in St. Louis, Mo. Lyle W. Johnson, who has been serving in the capacity of Sales Manager since September, 1934, has been made General Manager, and A. M. Spooner who has been a salesman for the company in that territory for some time has been appointed Sales Manager.



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AND GRINDERS
Write for Circular on types, sizes and prices
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ELKHART INDIANA

Make Your *Own* Tests

Lansing Pneumatic Tired Barrow

for economy, with either or both of these handy helpers for builders, contractors, etc. F-25 barrow—capacity 4 cu. ft. wet concrete; K-4 Utility cart—6 cu. ft. dry material. Write for prices and details.

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Chicago New York Philadelphia Kansas City San Francisco Boston Minneapolis

Lansing K-4 Utility Cart—with Pneumatic Tired Wheels

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If PREFORMED WIRE ROPE SERVES YOU BEST
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Williamsport's method of preforming

"Form-Set" has the utmost in every quality—the toughest, most durable fatigue resisting Wire—the most minute accuracy in the sizing and fitting of the Wires—the most careful and exacting fabrication—plus precision Preforming.

Try "Form-Set" on a strictly comparative basis. It has the "stuff" and its performance will prove our every claim.

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How the Other Fellow Did It

Ideas Which Have Already Proved Helpful to Contractors

Triangular Frames for Racking Steel

Convenient Method of Racking Steel

379 A convenient method of racking steel rods and bars is employed at the maintenance shop of the Mason-Walsh-Atkinson-Kier Co., contractors on the Grand Coulee Project at Mason City, Wash. The shop is a steel building 75 feet x 150 feet, fully equipped and served by a 10-ton crane.

The crane runway is extended about 30 feet beyond one end of the building, the end wall of the building being capable of opening. On each side of the runway supports, outside the building, special racks have been built which hold the rods at right angles to the runway. These racks consist of four triangular members each, made of 5 x 8's and with the peaks 6 feet above the ground. Steel pins one inch in diameter are set in the sides of these triangles, spaced on 6 to 10-inch centers, and in straight rows across the four triangles.

The steel is run onto these pins from trucks backing up to the outside. As stock is needed in the shop, it is pushed out of the racks across the runway where the crane picks it up. Very little hand labor is required in handling from the time the steel is trucked in.

Underpasses Excavated by Contractor With Scraper

380 Several Chicago contractors have made use of the following method of excavating for underpasses beneath railroad viaducts with uniform success. The best part of it is that the cut is made without interruption to train service.

Parallel rows of piling are driven through the railroad fill to support the tracks while the work is in progress and then the earth between the rows of piling is scooped out with a slackline scraper. Before the scraper can start to operate, however, a shallow trench must be cut through the embankment to allow the backhaul cable of the scraper to be drawn through and passed around a tail-block attached to a bridle cable. Then the scraper begins digging against the face of the embankment and continues gouging into the bank until it has excavated its way clear through to the other side. At the forward end of the span, the scraper bucket can deliver the excavated material to motor trucks, loading the trucks through a trap at the head of a ramp, or can drag the spoil onto a pile to be reloaded and hauled away. SN 2.36

Bulldozer vs. Hand Labor on Buffalo Sewer Contract

381 When the Cornell Contracting Co. was working on a recent sewer contract in Buffalo, N. Y., it ran into an unusual condition where the sewer passed under the Erie Railroad.

Working a Bulldozer in Close Quarters

The excavation was handled all along the line by clamshell and crane, but where the sewer passed under the railroad tracks, it was impossible to work the clamshell. The problem of excavating the sticky clay under these tracks was solved by lowering a McCormick-Deering TA-40 tractor equipped with a 6-foot bulldozer into the trench and then working the wet clay in the close quarters back to where it could be picked up by the clamshell. The extra cost of doing this work under the tracks by wheelbarrow and shovel would have been around $1,500. IH:36

Handy Aggregate Batch Body

382 Three-compartment wooden batch bodies, like this, with separate hinged end gates, were found handy for hauling aggregates to the mixer by Frank M. Kinney, contractor on the 23rd Street viaduct construction, at Denver, Colorado.

A 3-Compartment Batch Body

Eight GREAT FEATURES GIVE IT RESULTS AT THE BLADE

..A money-maker for its owner on a wide variety of jobs

Why Users Prefer It

1. Powerful Diesel or gasoline motor.
2. 6 forward and 2 reverse speeds.
3. Floating drive—solid steel housing relieves the drive shaft of all weight and operating stresses.
4. Dual (8 tire) drive. Power on all drive wheels provides real traction.
5. Wide front axle with leaning wheels—prevents side slip—permits working in ditches.
6. Effective anti-chatter device—holds blade as in a vise.
7. Hydraulic controls—instant response for every operation from steering to reversing the circle.
8. Arc welded steel frame—weight is concentrated over the blade.

● Dirt certainly moves when this equipment goes into action!

The Austin-Western "77" has the efficiency, strength and power that is necessary for present day highway work. It combines eight great features, any one of which would make it an outstanding buy. It is a real producer of results—at the blade.

The Austin-Western Motor Grader handles so easily—is so adaptable that you will be using it on a wide variety of work. It is built to take punishment.

Write for booklet describing the Austin-Western "77" Senior Motor Grader.

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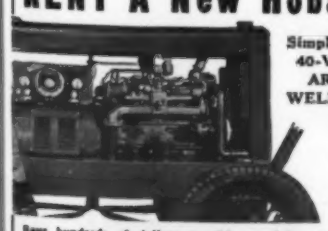

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HOBART BROS., Box CE-56, TROY, OHIO

A 2-Minute Exposure Showing a Pioneer Counterbalanced Screen in Action. Note Pencil and Jar of Water.

Gradation Screens Handle Five Sizes of Aggregate

Horizontal gradation screens, made by the Pioneer Gravel Equipment Mfg. Co., 1515 Central Ave., Minneapolis, Minn., in sizes ranging from 24x96 inches to 40x16 feet, with single, double or triple decks, are designed to separate five sizes simultaneously.

The larger sizes are so well counterbalanced that the vibration is confined to the screen and is not transmitted to the frame. These heavier and larger screens are equipped with SKF antifriction bearings. These screens are arranged to be operated with a shaker pan in a horizontal position. This pan is mounted in pairs of hangers and is so hung as to give the screen plates an upward and forward swinging motion, working the material across the screen as it is being screened.

The smaller sizes of these horizontal gradation screens are equipped with plain bearings and are not counterbalanced.

The complete specifications for the six sizes of these screens are contained in a new folder No. 513 which may be secured direct from the manufacturer.

The longest cement line ever built, nearly a mile and a quarter in length, will be part of the impressive process for producing cement at Grand Coulee Dam and is another of the "world's greatest" at this huge project.

Missouri Experiments in Treating Base Soils

(Continued from page 23)

tire length. This soil is predominately a silt with a few stretches of clay at low points in the grade line.

The Road-Plant-Mix Section

Since the success of the subterranean method was not certain, a check method was tried in Lewis County where the surface was scarified, the material windrowed and then mixed with the desired percentage of bituminous materials by means of a traveling plant.

The variations tried with the first method, including added granular material, were approximated under this method but at a considerably increased cost. The advantages hoped for in the second method were greater uniformity, better mixing and better control. Only about 6 miles of the contemplated 10 miles of test sections were completed before winter weather caused a shut-down but sufficient sections were constructed to give possibilities of an interesting comparison after the effects of traffic and weather during the winter season have been observed.

Because a pug mixer was used in the machine, it was necessary to add about 35 gallons of water per cubic yard of mixed material in order to secure a dischargeable mix. This added water did not immediately leave the mix and a number of sections were not sufficiently dried to permit traffic prior to freezing and accordingly cannot be spread until this spring. Sections which had a longer drying time carried traffic throughout the winter with little or no signs of distress. There is evidence, however, of a sponginess or rubbery consistency indicating that future additional consolidation will and should take place. No surfacing or seal of any type has as yet been placed on any section of this project. The predominate soil type at this location is clay. The cost of treatment by this method will probably be about $4,000 per mile.

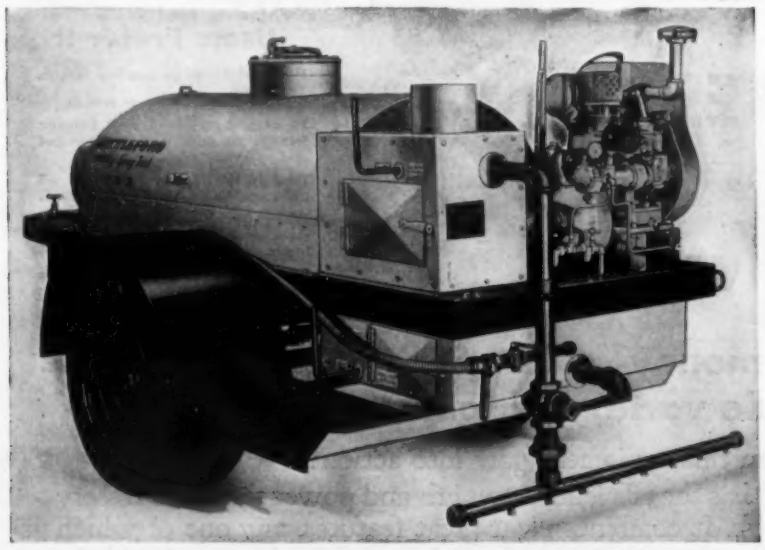
Pickup of Sound Waves Locates Underground Rock

By precise timing of sound waves racing through earth and through earth and rock, engineers of the U. S. Bureau of Public Roads have developed practical field methods for determining the distance below the ground surface to solid rock. The instrument by which such measurement can now be made on the surface of the ground is the highly sensitive electrical seismograph.

Accurate results are obtained by measuring the speed with which an impulse from the explosion of a buried blasting cap or small charge of dynamite travels through the ground. Such an impulse will travel through soil at a speed of 1,000 to 6,000 feet per second but the speed through rock is 16,000 to 20,000 feet a second. A cap is exploded in the ground and at the same time the electric current exploding the cap causes a record to be made with precise apparatus for measuring time. Special detectors are placed at different distances from the explosion and pick up the impulse as it comes through the ground. The detectors are electrically connected with the time-recording device and the time of travel of the impulse from the explosion can be measured to a small fraction of a second. Knowing the speed of travel through soil and through rock and the time of travel through different distances, it is possible to calculate how far the impulse went downward through soil before it encountered rock.

This same method has been used extensively in prospecting at considerable depth for oil, although the apparatus used has been elaborate and costly. The U. S. B. P. R. engineers have now developed a simplified apparatus which is giving excellent results.

It has always been my view that the best money which can be spent from the standpoint of profit to the agricultural class of this country is the money which is spent for farm-to-market roads.—*Senator Bennett Champ Clark.*



The Ideal Maintenance Unit

More Littleford No. 101 Utility Sprayers were sold during March, 1936, than during any previous month since its announcement. This verifies the claim that no other unit is so versatile or so complete in the field of black top road maintenance.

Users who have benefited by the savings (up to 30% in many cases) in cost of bulk material as against drums and the additional savings in handling and applying time are adding to their fleets. Others awaking to the possibilities of the No. 101 are starting to use it.

Sizes from 300 to 1200 gallons capacity for either truck or trailer mounting are standard. For the ideal "big time" maintenance outfit, use the Littleford No. 101. Write for prices today.

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Road Maintenance Equipment

SINCE 1900

LITTLEFORD BROS., 485 E. PEARL ST. CINCINNATI, O.

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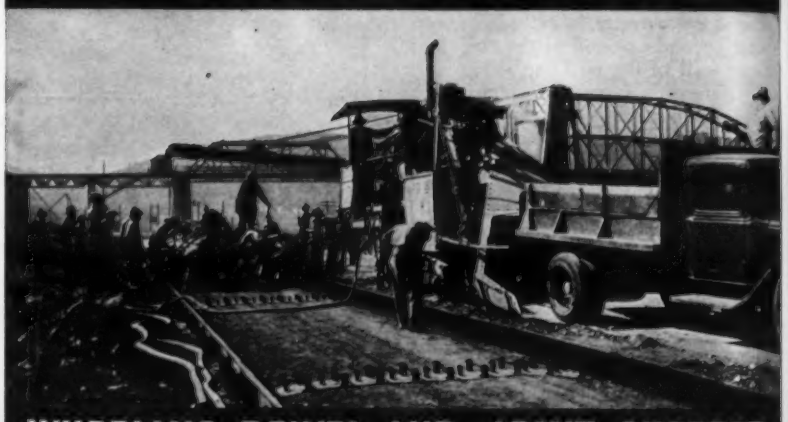


WHEELING DOWEL AND JOINT SUPPORT HAS *NEW and REVOLUTIONARY FEATURES*

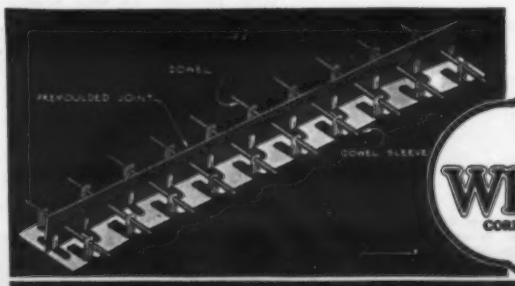
● Here is a modern device that overcomes the many difficulties of properly supporting dowel bars at transverse contraction and expansion joints during concrete road construction. It is a single piece of sheet steel 18″ wide, the same length as the joint, and flexible enough to conform to the sub-grade of heavy edge pavements as well as to those of uniform thickness. One inch from each lateral edge of the sheet, and spaced at equal intervals, lugs are punched and bent upward. These lugs have holes of a size to accommodate the size of dowel bar to be used, and lugs are of correct height to support the bars the required distance from the sub-grade or the finished surface of the pavement.

NO STAKES TO DRIVE — NO UNITS TO REMOVE

● With this Wheeling Support there are no stakes to drive into the sub-grade. One man easily takes care of all joints, both Expansion and Contraction. The entire Wheeling unit may be assembled on the sub-grade or alongside the road and lifted over to its proper place under the boom. Because the entire Wheeling device remains in the concrete—nothing is removed—a faster and better finished job is assured.

● Wheeling supplies Welded Wire Road Fabric for all concrete road reinforcement requirements.

● Write for details of this most modern method in road construction.



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Sugar-Coated Roads in British India

THE use of molasses as an inexpensive substitute for bituminous binders for road surfacing was discussed at the Indian Road Congress held last January at Bangalore, India, by the Chief Engineer of the Mysore Government in whose district some interesting experiments have been carried out.

The idea is not as new as it may seem for in the olden days it was a practice in India to add jaggery water (jaggery is a kind of coarse sugar made by evaporation from the sap of palm trees) to lime which resulted in an improved quality of mortar. At Mandya, there is a sugar factory and accumulated waste molasses is available on a fairly large scale. There are also quarries of limestone, from which the lime for general construction in Bangalore and Mysore is secured.

The Bangalore-Mysore section of the Madras-Cannanore road, about 86 miles long, has a heavy traffic of bullock carts, busses and motor cars. The annual grant for its maintenance is 36,700 rupees, or roughly 427 rupees a mile. (A rupee is worth about 37 cents). The grants for special repairs and from the Central Road Account have averaged for the past five years about 24,000 rupees or about 300 rupees a mile.

The portions of the road from Bangalore to Bidadi, about 20 miles in length, and between Seringapatam and Mysore, about 10 miles in length, are subjected to intense wear and tear, as they form the approaches to the large cities of Bangalore and Mysore. Efforts are continuously being made to keep them in order but the results have been disappointing. About 2½ miles at the Bangalore end and 2⅜ miles at the Mysore end of the road have been asphalted at a cost of 21,000 rupees. This surface is satisfactory but is not capable of standing the bullock cart traffic and expensive repairs have to be made periodically. Owing to lack of funds, it has been impossible to continue the asphalt surfacing.

Taking the cue from the old practice, a short length of road surface formed of lime kankar was treated with molasses and the result was so encouraging that at present about 50 miles of this road, the surface of which is composed of various kinds of metal such as granite, gneiss, dolerite, quartz, etc., is treated with molasses.

Method of Procedure

The old surface is swept of all loose dust with coconut fibre brooms to expose the interstices of the metal to a depth of 1/16 to 1/8-inch, care being taken not to dislodge the metal.

Molasses and water, mixed in a proportion of about 1:1, is applied over the cleaned surface, either by hand or by a tank truck provided with a spraying attachment, the quantity of molasses required being about 1¼ tons per furlong (220 yards) of 12-foot width. The mixture is spread out evenly over the surface and allowed to soak for half an hour, after which while it is still damp, coarse sand available nearby is spread over the molasses and traffic is allowed to pass immediately.

The process is both quick and easy. After a fortnight, the sand and molasses get worked thoroughly into the interstices by the traffic and the surface has a dark appearance, similar to a bituminous surface.

This method of surfacing roads only with molasses has been found to give a smooth and dustless surface in the dry season. However during the heavy rains, some of the molasses was dissolved and spread out to the sides. There was still a goodly portion left on the surface and it is expected that after the rainy season a renewal by a thinner solution of molasses will restore the surface to the required condition.

Molasses Mixed with Slaked Lime, a More Permanent Binder than Molasses and Water

The cost of surfacing the road amounts to about 140 to 160 rupees per mile for the first application, the amount varying according to the distance from the sugar factory to the site of application.

Molasses Mixed With Lime

Experiments are now being conducted to prevent the molasses from being washed out during the rains by mixing slaked lime with molasses before applying it to the surface. Molasses mixed with an equal bulk of well-slaked lime produces a chemical union. The slaking of the lime is easily done in a pit dug by the roadside or in a tub and the lime is allowed to slake at least for a day. The addition of a small quantity of charcoal powder will quicken the setting action, as it gives better aeration. The addition of burnt lime to molasses produces tri-calcium sucrate which is insoluble in water and therefore would not wash out.

The chief reason for molasses' suitability as a road surface is its adhesive and hygroscopic qualities, that is the power of absorbing water which helps to keep the road surface slightly moist, an important property as it not only makes the road dustless but also keeps the surface intact without allowing it to break up and form pot-holes.

The results of treating road surfaces with molasses have been very encouraging thus far, and further experiments are now being conducted to arrive at exactly the correct proportion.

Road System of Mysore

The development of the road system in Mysore is just a century old. Prior to 1831, Mysore had only a few unbridged roads maintained in an unsuitable manner. Since 1881, over 40,000,000 rupees have been spent on an orderly program of trunk roads and feeder roads with bridges across the major streams. There is today an excellent network of 7,092 miles of road, of which 3,966 have a metalled surface, in an area of 29,475 square miles, averaging 25 miles of road per 100 square miles. These roads may be classified as trunk roads, mostly metalled surface, establishing through communication between the east and west coast and connecting the District Headquarters and other important towns; and feeder roads between less important towns and villages.

While the needs of the towns have been fairly well met, only the fringe of the problem has been touched relating to village roads. There are, in Mysore, 19,421 villages and access to most of them is by narrow cart tracks, the maintenance of which seems to be nobody's concern. These tracks are merely two or more lines of ruts worn down by age, full of hollows, strewn with boulders and often passing over difficult terrain. A first step toward rural development lies therefore in establishing easy communication between adjacent villages and the nearest roads.

Assuming roughly an average length of 2 miles per village for connection with the thoroughfares, for communication between neighboring villages and for the conveyance of produce from the village to the markets, there have yet to be made about 38,842 miles of new roads.

Data furnished by Curtis C. Jordan, American Consul, Madras, India, through the U. S. Bureau of Foreign and Domestic Commerce.

New Works Mgr. Appointed by Amer. Hoist & Derrick

Harry J. Kicherer, formerly associated with the Caterpillar Tractor Co., has been appointed Works Manager for the American Hoist & Derrick Co., of St. Paul, Minn. Kicherer, who was with the Russell Grader Co. before it was absorbed by Caterpillar, is a graduate mechanical engineer of the University of Iowa and has had twenty years practical experience in the manufacture of construction and road machinery.

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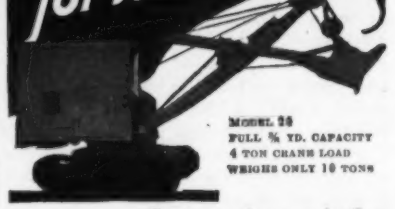

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- Drop forged crawler shoes.
- Chain crowd with automatic adjustment.
- Fast operating speeds.
- Safety worm boom hoist.
- Separate hoist drums.
- Full cab enclosing ALL machinery.

TYPES AND SIZES

Capacity	Model
⅜ yd.	20
½ yd. (Truck Shovel)	10
⅝ yd. (Tractor Shovel)	¾ Circle
½ yd.	30
⅝ yd.	38
¾ yd.	45
⅞ yd.	52
1 yd.	62
1¼ yd.	65

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ROCK CRUSHING *and* MATERIAL HANDLING

EQUIPMENT FOR EVERY JOB

30 YEARS OF MANUFACTURING AND DESIGNING SKILL ARE A GUARANTEE OF EFFICIENCY, DEPENDABILITY AND ECONOMY TO EVERY PURCHASER

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TELL US YOUR NEEDS ASK FOR CATALOG
←LIMESTONE PULVERIZERS

UNIVERSAL CRUSHER COMPANY

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Cableway Supt. Finds Model Aid at Bonneville

(Continued from page 15)

will be hampered. For example, take the sheaves on the tail tower. The original design may show no possibility of interference, but when the cableway is erected it may be found that there is serious interference. By first building a scale model exactly according to the plans, such interference may be discovered before the cable is erected, so that the design may be changed beforehand."

Cable Loft Well-Equipped

The cable loft is a sizeable building in itself, containing, in addition to an office, a larger room where there are kept special shackles, slings and running repair parts of all kinds. The equipment includes a complete blacksmith outfit, a 300-ampere G.E. arc welding machine, gas welding and cutting torches, electric stand grinders for smoothing built-up saddles, etc. There is also a special department for maintaining the equipment used between the tower operators and signal men.

A considerable organization is necessary to keep a cableway such as this in operation: about 50 men, including operators, signal men, hook tenders, oilers, maintenance crew and foreman and a foreman and four men in the electrical department. All lines and carriages are fully inspected once every 24 hours.

Caterpillar Exhibits at Midwest Power Show

The Caterpillar Tractor Co., Peoria, Ill., was represented at the Seventh Midwest Power Exposition held in the International Amphitheater Building in Chicago last month.

The unit on display was the D8800 40-kw diesel-electric generating set, consisting of a Caterpillar 4-cylinder 80-hp diesel engine direct-connected to a General Electric generator, and is in the middle of the company's line of five diesel power unit and industrial engine sizes ranging from 160 to 44-hp.

The progress of the world depends upon the men who walk in the fresh furrows; upon those whose faces are radiant with the glare of furnace fires; upon the delvers in mines, and the workers in shops; upon those who invent and discover; upon those who dare to pioneer, sponsor or promote; upon those who lead rather than follow.

—Robert Ingersoll

AS RUGGED AS THE ALL-OUTDOORS

Ordinary greases can't take it like these fine old Dixon Graphite products.

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Water insoluble — heat and weather resistant — all consistencies.

DIXON'S WATERPROOF GRAPHITED GREASE

Adhesive lubricant for outdoor machinery, gears, wire rope, chain, etc. High speeds will not throw it. Insoluble in any water.

WRITE FOR BOOKLET NO. 9-A1AR — AT SUPPLY HOUSES EVERYWHERE

JOSEPH DIXON CRUCIBLE CO.
Jersey City, N. J.

Repairing Flood Damage to Roads and Bridges

The special funds now available for repairing flood damage to roads and bridges on the Federal-Aid system are estimated to be sufficient to pay half the cost of restoring with modern structures most of the bridges on the system destroyed in the recent extraordinary floods, according to an estimate by Thomas H. MacDonald, Chief, U. S. Bureau of Public Roads. These specific funds amount to more than $7,000,000 of the $10,000,000 authorized by the Hayden-Cartwright Act of 1934. Federal participation in this restoration work is limited to half the cost.

"When such floods occur," said Mr. MacDonald, "almost without exception it is the old-time structures that are seriously damaged or totally destroyed. This does not mean that the loss of the facility to the community is not serious or the replacement costly, but that modern design is producing bridges that do withstand extraordinary floods."

Flood damage, although spectacular, caused much less loss than did the deterioration over many miles of pavement and wide areas caused by the severe winter, Mr. MacDonald said.

Rising insurance rates for workmen's compensation, their effect on the contracting business and how this problem can be met will be discussed in an article in our June issue.

PORTABLE ASPHALT PLANTS
TOWER TYPE
LARGE CAPACITIES
HOT OR COLD MIX

Accurate control of materials to comply with any standard specifications for bituminous mixtures.

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Indianapolis, Indiana

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Metal Accessories for Highway Construction

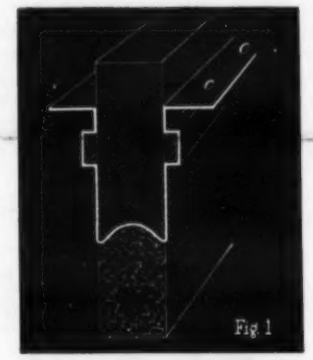


Fig. 1

FIG. 1

illustrates the metal housing for the fibrated asphaltic joint showing control of oozing of upper structure. The base is prepared from a non-oozing material.

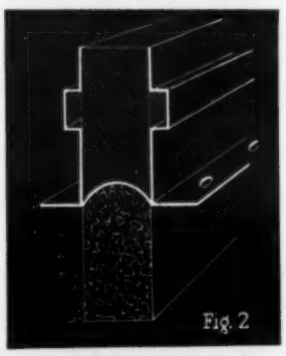


Fig. 2

FIG. 2

illustrates a fibrated asphalt top showing metal escape containers with a fibrated asphaltic top and a sponge-rubber, premoulded cork joint or fibre board base. The structure has an intermediate seal.

Fig. 3

FIG. 3

illustrates a combination seal imbedded in fibrated asphaltic top and the escape apertures as well as the seal absolutely controls the fibrated asphalt flow. The base has a copper seal.

FIG. 4

illustrates an extruded fibre mastic product provided with grooves for the metal accessories used in connection with flow control. Escape dowel locks and supports and upper escape and seal combination control oozing tendencies in this joint. The metal forms contribute to the rigidity of the joint and afford a simple economical means toward a positive seal. The means of properly housing the dowel bars so as to hold the dowel bar in rigid position while the concrete is being poured is effective and certain.

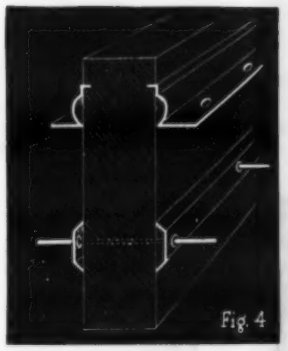


Fig. 4

FIG. 5

illustrates an upper seal which can be utilized with a backing board or with a prepared joint filler in which the joint may be poured or filled and a positive seal formed thereover. 5a-5b departures from 5.

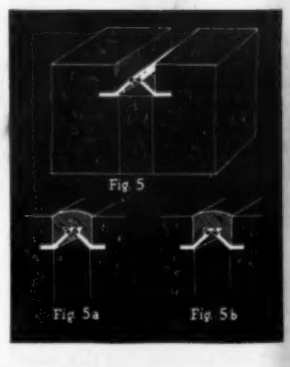


Fig. 5

Fig. 5a Fig. 5b

FIG. 6

illustrates a separate metal housing seal.

FIG. 7

illustrates a metal form for the base seal.

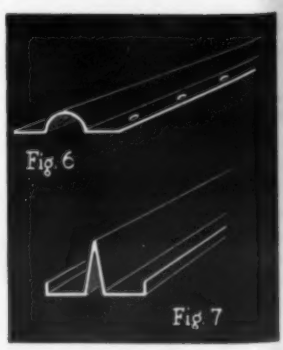


Fig. 6

Fig. 7

NOTE: All the benefits of a metal cushion joint are obtained and in addition a waterproof filler and seal with greater flexibility at lower cost.

In conjunction with the above, we furnish extruded fibrated asphalt material with the fibre content in greater relation to the asphalt content so as to furnish some resiliency. This material comes grooved with a suitable affixing of dowel supports and escape cushions.

We also furnish extruded sections such as curb cushions; bridge plank, mineral surfaced, standard and ribbed; and our metal accessories in conjunction with highway and bridge construction.

We specialize in extruded forms to meet various engineers needs.

SERVICISED PRODUCTS CORP., 6051 W. 65th St., Chicago

Koehring's New Model 251

New High-Speed Excavator Announced by Koehring

The Koehring ⅝-yard Model 251 shovel, crane, dragline, trench-hoe, recently announced by the Koehring Co., 3026 West Concordia Ave., Milwaukee, Wis., is a high-speed light-weight machine. The use of high-strength special steels, combined with welded construction and simplified design, has produced exceptional strength with a substantial decrease in weight, according to the manufacturer. Model 251 is fully convertible, with a ¾-yard rating as a crane or dragline. Attachment changes are easily and quickly made on the job with minimum labor.

Many Koehring features are incorporated in this new machine. It is easily operated and a simple gear shift provides two selective swing speeds to synchronize with the arc of swing and the height of lift. Two traction speeds give power in tough going and speed in easy traveling. Positive steering for any angle is easily accomplished from the lever position in the cab. Full vision is assured the operator in the cab who is protected by safety glass.

Convenient and free accessibility of all parts is a time-saver when adjustments are necessary. Each shaft can be independently removed. Drums are equipped with quickly removable barrels. Gears are enclosed and run in an oil bath. Anti-friction bearings are used to eliminate power waste.

Road Progress in Mexico

The development of highway systems in Mexico has become an important matter in recent years and it is the policy of the Mexican government to advance road building programs as rapidly as funds become available for these purposes. Since Mexico is fairly prosperous and with revenues exceeding expenditures, it appears likely that construction will be reasonably rapid, according to a report from the U. S. Bureau of Foreign and Domestic Commerce.

Thirty-five million pesos, or very nearly $9,800,000, has been allotted for highway construction in the 1936 budget. In addition to this sum an additional 11,000,000 pesos, or $3,080,000, has been appropriated by the various states for this same purpose, making a total of 46,000,000 pesos ($12,880,000) to be spent on highways in Mexico during 1936.

The appropriation of the central government has tentatively been divided into the following projects: 9,000,000 pesos ($2,520,000) to be spent in the construction of a road from Mexico City to Guadalajara, a distance as the crow flies of about 300 miles; another 3,000,000 pesos ($840,000) for the final work on the Laredo-Mexico City highway, the northern end of the Inter-American Highway described in our January issue; 1,500,000 pesos, ($420,000) for the completion of the surfacing of the Mexico City-Acapulco road; and the same amount for work on the Ariaga-Chiapas road. The appropriations made by the various states will be used largely for local and side roads.

Highway construction is under the supervision of the Ministry of Communication and Public Works, known as the Secretaria de Comunicaciones y Obras Publicas. American contractors have in the past participated in the construction of the Laredo-Mexico City highway. It is the present policy of the government, however, to award contracts to Mexican concerns insofar as possible. Bids from foreign contractors are given consideration where such companies are in a position to finance the projects until such time as the government is in a position to pay them.

ALL EYES ARE ON

The New
Three-Axle Tandem
BUFFALO-SPRINGFIELD
whenever and wherever
it performs!

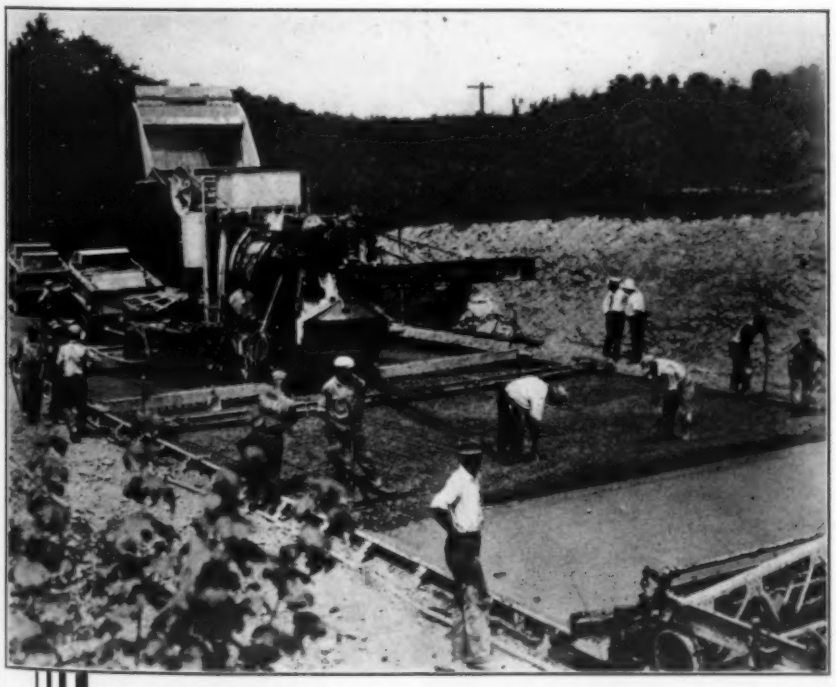
It certainly does give a marvelous performance — no bumps are left on the road after this machine passes over!

On ALL jobs, it's a BIG money saver!

Circulars on this and other models for jobs both big and small, sent on request.

THE BUFFALO-SPRINGFIELD ROLLER CO.
SPRINGFIELD, OHIO

THREE PAVERS WERE SPECIFIED - - - -
ONE RANSOME DUAL DRUM PAVER DID THE WORK!



The York Engineering & Construction Co., York, Pa., had a contract for concrete paving a 12 mile section of Route 8 in Pennsylvania. In sending out requests for bids, the State specified the use of three pavers in order to make sure that the job would be finished the same year.

But the contractor finished the entire job 42 days ahead of the specified time, using only *one* Ransome Dual Drum Paver.

The reason is simple. The Ransome Dual Drum Paver will speed up yardage laid by at least 50% and, in many cases, by 75%. You owe it to yourself to investigate what it can do.

Let us send one of our men to explain what this modern paver can do, especially on the particular work ahead of you.

RANSOME CONCRETE MACHINERY COMPANY
DUNELLEN, NEW JERSEY

Agents In All Principal Cities Cable Address: "Racomaco" Dunellen

The Eimco-Finlay Loader

An Air-Operated Loader for Tunnels and Drifts

A self-propelled mechanical loader for use in drifts or tunnels, which is operated by one man, is made by the Eimco Corp., 634-666 So. 4th St., West, Salt Lake City, Utah. This Eimco-Finlay loader, in the smaller model, operates on track gages from 18 to 30 inches and can be furnished to load cars having a maximum heighth above the rails of 54 inches and of any practical length. In driving water tunnels of small bore, the low headroom and limited width of the Model Eleven are unusually efficient. Being no larger than the average 16-cubic foot car, this loader is especially suitable for loading in confined places, either under or above ground, as it will operate in a space 4 feet wide by 5 feet 8 inches high. In addition to being a mechanical loader, it acts as a pneumatic locomotive and will switch loads within the range of its air-hose connections.

Model Twenty, intended for use in large drifts and tunnels, operates on track gages from 24 to 42 inches and can be furnished to load cars having a maximum heighth above the rails of 66 inches and of standard car length. It operates with the same ease and flexibility as the Model Eleven and is identical in general design though twice as heavy.

This loader is operated by two Ingersoll-Rand compressed air motors, Model Eleven consuming from 30 to 70 cubic feet a minute at pressures ranging from 60 to 90 pounds and the larger model requiring from 60 to 140 cubic feet a minute at pressures ranging from 70 to 100 pounds. One motor furnishes the power for propelling the loader which is also its crowding function, and the other motor furnishes the power for digging, loading, lifting and dumping. All operations are controlled from one side of the machine through quick-acting throttles.

It is claimed that the Model Eleven will load a 20-cubic foot car in from 30 to 45 seconds, and Model Twenty will regularly load a 40 to 50-cubic foot car in 30 and 45 seconds. It has handled as much as 300 tons per hour in driving a large 10 x 12-foot transportation tunnel.

Drainage Tile Tested for Alkali Resistance

Beneath the alkali waters of Medicine Lake, near Watertown, S. D., lie thousands of small concrete cylinders and drain tile, placed there by engineers of the U. S. Department of Agriculture to determine what concretes best resist destruction by alkali salts.

About 1919, concrete tile drains in farm lands of southwest Minnesota were reported failing. Examination showed deterioration from alkali salts in the soil, the alkali eating out the lime of the cement in the concrete. The development of resistant concretes by the Bureau of Agricultural Engineering began at the laboratories established in 1921 at University Farm, St. Paul, in cooperation with the University of Minnesota and the Minnesota Department of Conservation.

Although the experiments are by no means finished, it already has been shown that concrete products cured at a temperature of 100 to 150 degrees F. can be made much more alkali resistant at small cost, about one-fifth of a cent per foot for 6-inch tile, by adding calcium chloride to the mix. Concrete tile made and cured by this method are still good after 3 years in Medicine Lake, although similar tile without this treatment went to pieces in less than a year.

Medicine Lake, 300 or 400 acres of clear water, with stretches of gravel beach, is an ideal and inexpensive laboratory for these tests. It has a concentration of magnesium and sodium sulphates, the salts which caused the trouble in Minnesota, much greater than that of soil water ordinarily found in agricultural lands.

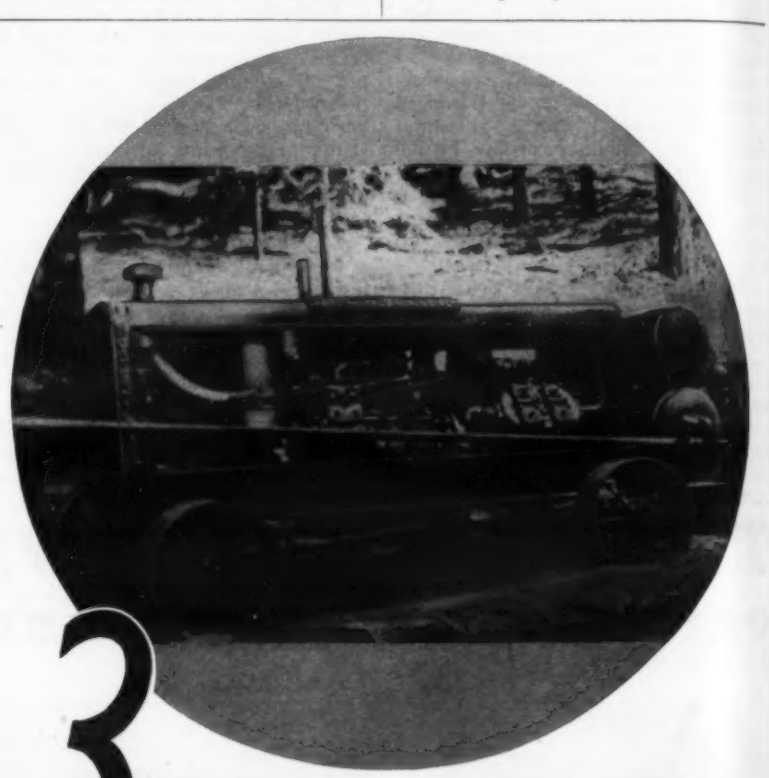
To develop the highest resistance in drain tile, sewer pipe and other concrete products, they should be steam cured when 12 to 24 hours old at temperatures of 212 degrees F. for 48 hours or longer. Higher temperatures are more effective so that at 350 degrees F. a 6-hour curing period gives remarkable results.

Other ways of making concrete products more alkali resistant have been developed, but few of them are as inexpensive as the use of calcium chloride in conjunction with moderately high curing temperatures.

Work in the laboratory has shown that portland cements themselves vary greatly in alkali resistance and cements from all parts of the United States are being tested. Bidders for cement for the Fort Peck Dam on the Missouri River were asked to state whether their product had been tested in the St. Paul Laboratory.

"Since 1921, there have been no failures of concrete tile in any public ditch in Minnesota where engineers for the ditches cooperated with the laboratory at St. Paul," said S. H. McCrory, Chief of the Bureau of Agricultural Engineering. "About 1,250 miles of tile have been laid at a cost of nearly $4,000,000. For about 75 per cent of it the laboratory gave assistance."

Studies are now being made to show what effect calcium chloride will have in tile exposed to the action of acid peat and muck soils. Ordinary concrete tile after eleven years in a high acid peat has failed completely.



3500 HOURS WITHOUT A FORCED SHUT-DOWN -JOB FINISHED

SINCE 1859

That is the story of a Gardner-Denver 315' Caterpillar Diesel-driven Portable Compressor, used by a prominent western contractor on the Yosemite section of the Oak Flats Highway.

GARDNER-DENVER COMPANY, 102 Williamson St., Quincy, Illinois

GARDNER-DENVER

» 7S and 10S machines or other MASTER and SILVER-STREAK Non-tilts from 3½S to 28S, WONDER Tilters from half-bag to two-bag capacity, also CMC Hoists, Plaster and Mortar mixers, Pumps, Saw Rigs, BETTER BILT Wheelbarrows, Concrete and Material Carts with steel wheels or pneumatic tires. » » » »

CONSTRUCTION MACHINERY CO., WATERLOO, IOWA

Road Construction by Indiana County

(Continued from page 11)

when the size goes beyond this. The result of this project was a clear roadway of 36 feet with an 18 foot metaled surface. Upon completion of the grade we first metaled the roadway with 6 inches of creek-run gravel, following it a few months later with a course of approximately 2 inches of screened gravel from 1-inch to sand. The complete cost of the project was $4,000.00.

Tackling a Bigger Job

Having gained experience on this project, we were ready to tackle another more important and much larger job, that of the Brookville-Oldenburg Road, running west from Brookville, some 17 miles in length. It is the only direct route between the two towns, the next nearest route being about 10 miles longer. In 1926 the people of the Oldenburg community persuaded the county commissioners to contract for and build 4 miles of waterbound macadam from Brookville west. The project was then dropped, but in 1933 we placed on this 4-mile stretch a 2-inch tar mixed-in-place surface. During the fall of the same year, we graded an additional 4 miles, and the following year surfaced it with a tar top. This brought us to that section of the road which had originally inspired the movement for a new highway. Here the road followed a ravine down a long, winding hill, crossed a creek and followed up a steep, crooked grade into the town of St. Mary's which lies midway between Brookville and Oldenburg. This section of the road, at no point, was over 12 feet in width, and for at least a half mile would not permit two cars to pass. It was not possible to widen the road without going into a heavy construction project comprising heavy cuts and deep fills. A contract proposition was out of the question, due to the limited funds in our county highway budget and with no recourse to a bond issue.

Our county engineer made an extensive survey of this section of the road and in cooperation with the county commissioners, county council and county road supervisor, a plan for the project was agreed upon. In addition to earth moving, this plan called for the building of a 5 x 5-foot box culvert, the installation of two 30-inch corrugated iron pipes and several smaller pipes. The new 5 x 5-foot box culvert cost $400.00 including all labor, steel, cement, forms and other materials. This culvert replaced one of the same size that had been built by contract a few years previous at a cost of $1,100. The earth moving figured 40,000 cubic yards for cuts, some to be used in making fills and approximately 7,500 cubic yards of borrow. In estimating the cost of earthwork, we decided that it would be economy to purchase a shovel of our own for this amount of work. We were able to find a used, rebuilt Universal ¾-yard shovel at a price of $2,500.00, which we purchased. Our costs on the project show that at the rate of $4.50 per hour this shovel paid for itself on this one project.

The maximum cut was 34 feet and the maximum fill 40 feet. The cost of moving earth, approximately 40 per cent of which was side casting and the remainder hauled less than 1,000 feet, was 18 cents per cubic yard. The shovel work was not by any means ideal as considerable shale and rock was encountered in the hillsides. All labor involved, such as required in sloping banks, installing culvert, etc., was furnished from our maintenance crew, and trucks, tractors, graders, etc., were all our own equipment.

For the road surface, we spread approximately 12 inches of creek gravel and subsequently have applied about three courses of crusher-run stone from 1-inch to dust. We were at work on the job exactly 146 working days, and the cost was approximately $12,500 for the completed job.

The road was opened to traffic in the early fall of 1934, and it is our intention to place a black top on it during 1936.

From a paper presented at the Twenty-Second Annual Purdue Road School, Lafayette, Ind.

Spring Headaches

"What a winter for cold weather, ice and snow! And have the highways and highway maintenance men caught their share of trouble! All credit is due the men who gave their best efforts for long hours, often without food and rest, in order that traffic could get through," states an editorial in *The Highway Magazine.*

"These men deserve a breathing spell, but will they get it? We fear they will not because motorists everywhere, farmers, newspapers and detour bulletins tell the story of damaged roads.

"While it is true that water and ice and freezing temperatures have directly damaged some road surfaces, the biggest trouble lies under the surface—water in the subgrade. The evidence is plentiful and it is indisputable. When you see water oozing up out of the cracks of pavements on hill tops, at the ends of cuts and on level stretches—when you see bituminous surfaces, gravel roads and others heaved and rutted—and when you see ditches filled with water or with mud slumped down from the backslopes, you can expect trouble. Those road surfaces were never designed to stand up with so little support under them. Traffic passing over them is bound to break them up.

"But what will be done about it? Will you dump gravel and stone where you dug out the silt and clay of frost boils; will you regrade the roads and retreat the surface; will you use the mud pump to level up the cracked and uneven slabs? These things are like 'rubbing liniment on a broken leg.' What guarantee do you have that the same 'act of God' will not occur again next year and the next year and the next?

"Fortunately many highway and street officials now realize that there is a remedy that works in nine cases out of ten. Water is the cause and drainage is the cure. These spring headaches can be avoided by taking action now while the memory of present conditions is still fresh."

First Aid for Snake Bites

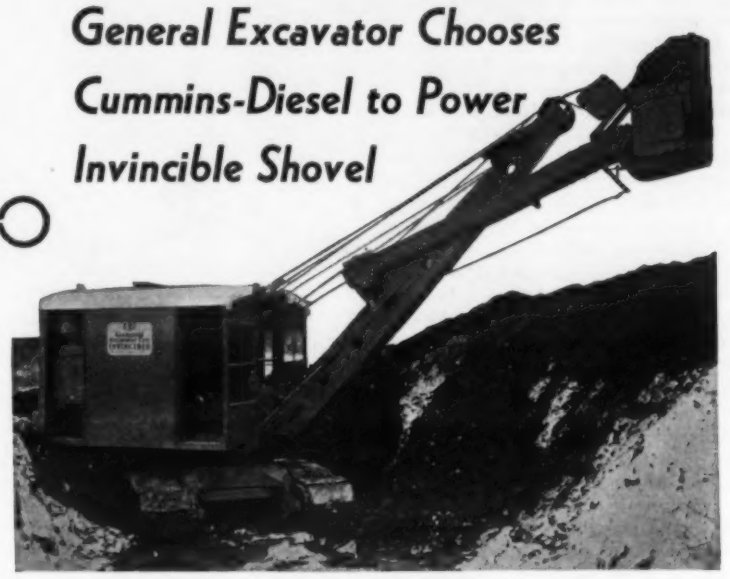
No—it isn't a flask of White Mule or even Haig and Haig! It's a canvas belt or pocket kit, measuring 4x3x2 inches and weighing only 10 ounces, containing complete first aid treatment for snake bites and common injuries encountered on construction jobs and those working along roadways, often at a considerable distance from a hospital.

The snake bite kit contains everything required for proper first aid treatment in accordance with modern medical recommendations. An antiseptic bottle is handy for treatment of wounds and the first aid kit contains an assortment of dressings and treatments most frequently required. All units in both kits are unbreakable.

A descriptive circular on these kits may be secured without obligation by writing to the manufacturer, E. D. Bullard Co., 275 Eighth St., San Francisco, Calif., and mentioning CONTRACTORS AND ENGINEERS MONTHLY.

Read the record

General Excavator Chooses Cummins-Diesel to Power Invincible Shovel



This is the first of several Invincible Shovels to be powered with Cummins-Diesels.

A COMPANY who puts "everything" into building a shovel and features it as "The finest excavating machine we know how to build . . . the excavating machine of tomorrow" . . . is certain to be especially careful in their choice of an engine with which to power it.

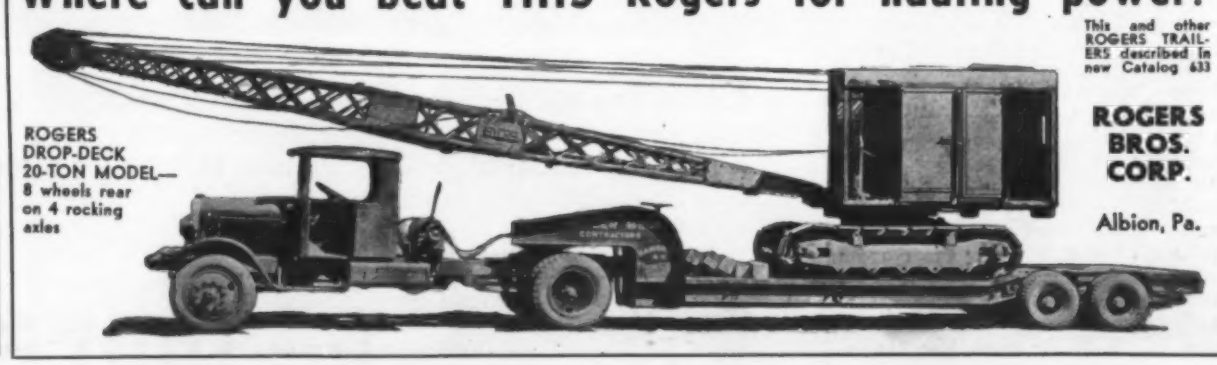
General Excavator Company's selection of the Cummins-Diesel is therefore significant.

Whether you are considering the purchase of new heavy duty machinery and trucks or planning the replacement of obsolete, worn-out equipment, it will pay you to investigate the exclusive features of the Cummins-Diesel, which make this Diesel the choice of experienced engineers.

Talk with your nearest Cummins dealer or write direct to the Cummins Engine Company, 604 Wilson Street, Columbus, Indiana.

CUMMINS
INDUSTRIAL AUTOMOTIVE AND MARINE
DIESELS

Where can you beat THIS Rogers for hauling power?



ROGERS DROP-DECK 20-TON MODEL—8 wheels rear on 4 rocking axles

This and other ROGERS TRAILERS described in new Catalog 633

ROGERS BROS. CORP.

Albion, Pa.

Ten-Year County Program Urged by Tenn. Engineer

(Continued from page 1)

county of Tennessee, located in western Tennessee with no metal for road surface available locally. We have 1,000 miles of county-maintained public road, 250 miles of which have been surfaced with gravel under a $1,500,000 bond issue in 1929 and 1930.

In preparing our program we included 160 miles of cleaning right-of-ways, straightening and widening, grading and drainage, 240 miles of gravel resurfacing, painting steel bridges, replacing and painting hand-rails, the control of roadside ditch erosion, building shoulders and raising fills. Our project calls for 179 common laborers, 6 truck drivers, 2 loaders, 2 dumpers, 4 timekeepers, 3 tractor drivers, 3 grader men, 6 bridge carpenters, 6 bridge painters, 2 surveyors, and 6 foremen.

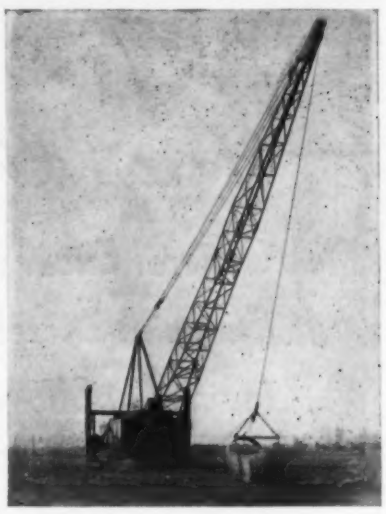
This project called for $31,493 Federal funds, $21,870 of this for labor and $9,623 for materials. The county contribution was set up as $4,200 for labor, $672 for materials, and $8,625 for equipment rental, making the total cost to the county $13,497.

We began work here on October 25, 1935, on a five months program, with six crews, approximately 30 men to the crew, working in various sections of the county. The crews are subdivided into sections, with a subforeman on each section. Part of the men were put to work clearing right-of-ways and removing fences, etc., part to cutting and sloping banks preparing for graders, some making fills with wheelbarrows and others placing culverts or bridges. The crews and the amounts of the various operations varied on each project. On the gravel roads we rebuild the shoulders, remove dirt from high shoulders to low places with trucks, build ditch weirs with brush, backslope irregularly cut section, clean out lateral ditches and remove all debris near the drainage structures. The bridge crew replaces decayed or damaged hand-rails, paints these and the steel bridges throughout, repairs abutments and cleans grass from around timber structures. When we are resurfacing a gravel road, we use the number of men that are required in the cars unloading gravel and a few on the roadway spotting dump trucks and spreading the gravel.

Progress Thus Far

For two months we were able to make very good progress for as a rule the labor was fair. However, due to bad weather during the winter months, not much was accomplished. With the project approximately 70 per cent advanced, it is about 50 per cent completed. We have cleared right-of-ways on approximately 100 per cent of project; however, grading is not over 20 per cent complete. We have placed new surface on about 3 miles of road and resurfaced approximately 180 miles, also rebuilt shoulders, ditches, etc.

The contract that Gibson County is working under now is for five months and at the end of this we expect to have a larger program for a period of eight to twelve months which should allow us to improve to some degree practically every rural route road in the county. However, I feel that there should be worked out a ten-year program for continuous improvement to rural route roads. It would take ten years at least to bring all of our rural roads out of the mud and have them surfaced for all-the-year automobile and truck traffic. This would be the best way to get the most benefit for the money expended for Federal work relief, as in low-type road construction the cost of materials is lower in percentage to cost of labor than any other worthwhile projects that I know of. With the trunk line system being gradually completed, surely the secondary road should come in for its part of the Federal money from future appropriations.



The New Page Dragline

New Walking Draglines Announced by Page

A new type of walking dragline, built in sizes ranging from 2½ to 20 cubic yards and known as series 600, has been announced by the Page Engineering Co., Chicago, Ill., to supplement the other walking, crawler and truck type draglines which have been manufactured by this company for a number of years.

The new series 600 Page walkers are of the two-shoe type. By means of a direct drive from the engine to the cranks attached to the side-mounted shoes, movements are made, lifting and sliding the machine for a step of 6 feet. The steps are automatic at the rate of three a minute. The complete walking mechanism is based on a simple, positive crank action. When the machine is digging, the shoes are held well above the ground by an automatically set brake.

The 600 Page walker is completely movable in any direction and is powered by a medium-speed horizontal Page diesel engine. The large base or tub gives ample footing for working even in very soft ground, the high fairlead is claimed to save wear on the cable, the boom is of welded alloy steel, and the unit has high swinging hoist and load speeds.

Complete specifications on this machine may be secured by readers of this magazine direct from the manufacturer.

Caterpillar Official Pays Tribute to Road Builders

H. P. Mee, Vice President of the Caterpillar Tractor Co., paid tribute to the road builder in a recent address before a large gathering of contractor and township, county and state highway officials attending the 1936 Machinery Show at Peoria, Ill.

"One sure sign of the progressiveness of any state is the extent and condition of its road system. The highways of the North suffer the rigors of winter, of the West, the sweep of dust storms, the South, torrential rains. But these problems only encourage the road builder to greater effort. I pay this tribute not only to those who use the roads and who pay the cost of building and keeping them up, but to you men who have to shoulder the responsibility of doing the job."

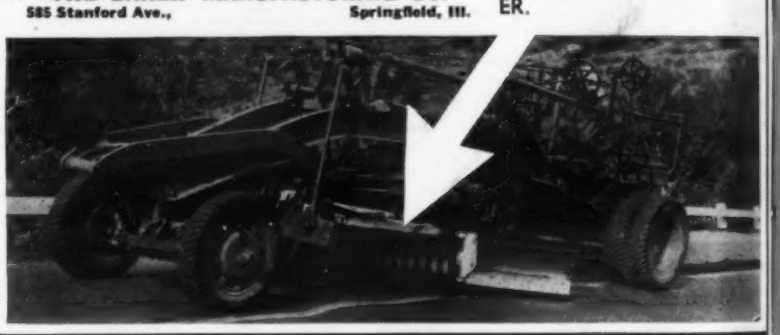
Better roads have been made possible by better machinery, Mr. Mee added, and such machinery is obtainable only by the employment of the best workmen to produce it. The aim of the Caterpillar company has been to contribute to the good roads of this country the best possible equipment and to that end has endeavored to provide the best of working conditions for the carefully selected workmen who produce Caterpillar machines.

WRITE FOR CIRCULAR
on the
South Bend
MODEL 200
BITUMINOUS MATERIAL DISTRIBUTOR
—Applies 1/10 to 3 gallons per square yard
—Distributes any width up to 22 feet
—Has a rated capacity of 300 to 2000 gallons
—Can be mounted on any truck or trailer

MUNICIPAL SUPPLY COMPANY
SOUTH BEND INDIANA

BAKER
Cuts out the road humps. Scarifies but does not dig. Makes a discing machine out of your grader at a small investment.
Send for Bulletin No. 576
THE BAKER MANUFACTURING CO.
585 Stanford Ave., Springfield, Ill.

DISC GRADER ATTACHMENT
IT MOUNTS ON THE MOLDBOARD OF YOUR MOTOR PATROL. NO EXTRAS—NOTHING TO TAKE OFF YOUR GRADER.



It's a Money-Maker

Efficient, dependable, 8 yd. capacity—Heil Dig-N-Carry Hydraulic Scraper.

HEIL Dig-N-Carry scrapers are MONEY MAKERS because they save money by doing a better job—FASTER . . . Send today for your free copy of the new, Heil Scraper bulletin . . . Address your inquiry to:

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HOISTS · BODIES · TANKS
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OIL BURNERS · WATER SYSTEMS

Welding Doubles Bridge Capacity

Economy of Repair by Welding Demonstrated on Old 290-Foot Highway Bridge at Lowell, Mich.

TIME was when it was just about as economical to replace a weakened bridge as it was to repair it, particularly if the job required replacing or strengthening a considerable portion of the steel work. Today, however, through application of arc welding, it is decidedly more economical to make repairs.

A recent example, which is typical of how arc welding is being employed in bridge repairing, is the reinforcing of a 49-year-old structure at Lowell, Michigan. This bridge, which is 290 feet long and 20 feet wide at the roadbed, had become considerably weakened by corrosion and other effects of long service. The condition of the bridge, plus increased load carrying demands, made the reinforcing necessary. The use of arc welding in strengthening important structural members more than doubled the capacity.

Procedure

To get at the main supporting members, 10-inch I-beams running the full length of the bridge, the old wooden flooring was removed. The I-beams were reinforced by welding 16-foot lengths of ⅜-inch plate to the tops and bottoms of the beams. The width of the plates, welded to the top of the beams, was less than that of the beam. The purpose of this was to permit the making of continuous downhand welds along each side of the plate and connecting it to the I-beam. The width of the plate welded to the bottom of the beams was greater than that of the beam, also to permit welding in downhand position. This construction enabled the bridge to carry more than twice the original load. All beams were tied together transversely by cross members welded to them.

Reconditioning the bridge also included provisions for taking care of expansion and contraction. Expansion joints were provided at the three points where the main structural members are carried on rollers, at each end and at the center. These joints were made by welding a 4 x 6 x ⅜-inch angle to the ends of the I-beams. The angles are placed so that the 4-inch side of one is over the corresponding side of the other. With this arrangement, the road surface of the bridge remains smooth under expansion or contraction, since the 3-inch plank floor of the bridge, when laid, is flush with the tops of the joint.

To hold each I-beam securely to the bridge piers, and at the same time to allow for free movement of the supporting members during expansion or contraction, each beam is carried in welded guide plates. As indicated, the guide plates are made by welding pieces of plate to the supporting rollers so that they overlap the bottom flanges of the I-beams.

Welding was also used to join the two central angles extending the full length of the bridge and provide for bolting the floor planking in place and the two guard rails (steel channels) extending along each side of the roadway. The channels have their flanges extending outward, with the smooth face inward.

Personnel

A total of approximately 265 hours of welding was required on this bridge. This was all done by the Michigan Welding Co., Grand Rapids, Mich., with Lincoln shielded arc equipment. The repairs were made for the Kent County Road Commission under state supervision.

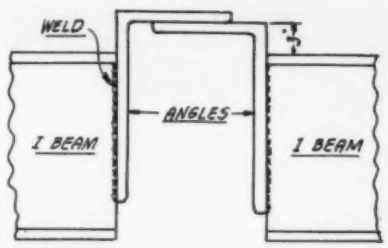


Diagram Showing Use of Angles Welded to I-Beams to Form Expansion Joint

Highways Pay Their Way

Good roads pay their way by reducing the operating costs of vehicles using them, and on heavily-traveled roads they return substantial profits to the public, reports the U. S. Bureau of Public Roads after a study of the mileage of vehicle travel in three states in comparison with highway expenditures. Annual payments for highways amount to slightly more than one cent per mile of vehicle travel on all highways in Wisconsin, Michigan and Minnesota, according to figures collected by the Bureau. In Wisconsin and Michigan the payment is 1.08 cents per mile and in Minnesota 1.1 cents per mile.

Analysis of highway costs and travel on the state systems, which include Federal-Aid roads, of Wisconsin and Michigan shows that payments amount to 0.83 cent and 0.86 cent per mile of travel respectively. The figures for county roads are 1.23 cents in Wisconsin and 1.66 cents in Michigan.

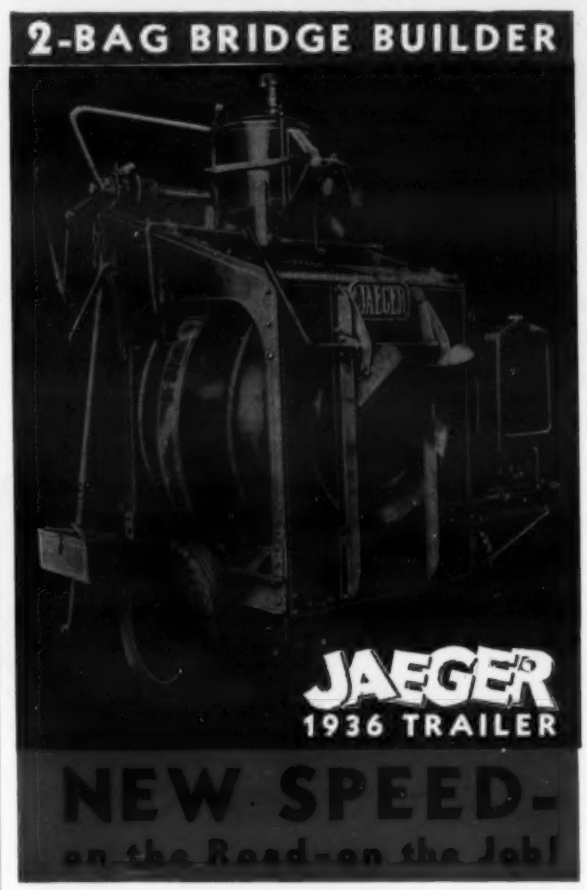
The lower costs for main highways agree with the well-established rule that large volumes of traffic make possible the construction and maintenance of high-type surfaces at a very low cost per mile of travel.

The actual saving in vehicle operating cost resulting from replacing a dirt road with a smooth, hard surface has been variously estimated and is probably not less than 3 cents a mile. On this basis, reports the Bureau, a large mileage of highways is paying tremendous profits to highway users. Actual payment of gasoline taxes and motor vehicle fees, when distributed in proportion to travel on different roads, show that many highways are earning substantial profits for the public.

Travel on the roads of Minnesota is not as heavy as in the other two states and payments for highways amounted to 1.4 cents per mile of travel on the state system and 1.3 cents per mile on county roads.

These figures are based on travel on all roads of each of the classes and are not restricted to travel on those that have been improved.

State highway departments normally consume one-third of the cement production in the United States.



NON-TILTS:

Standard 4-Wheel Mixers in 10S and 14S sizes; faster, more compact 28S and 56S mixers.

TILTERS:

Pneumatic Tired Trailers, Power Loaders—3S, 3½S, 5S, 7S sizes—High speed "Dual Mix" Drum.

Timken Screw Thrust Hoists.

"Sure Prime" Pumps 2" to 10" Sizes.

Pneumatic Tired 11 Ft. Concrete Buggy.

SET a new pace for concrete work with this latest Speed King. You can haul and place it in the time it takes to back a 4-wheel mixer into position. Load faster with Jaeger Skip Shaker—discharge the stickiest mixes in 7 seconds with Jaeger's "Forced Discharge" bucket action and special spoon—take advantage of its end discharge to pour direct into your forms.

Two spring mounted, Timken Bearing, pneumatic tired wheels trail at 35 m. p. h.—provide double the ground contact of 4 solid tires—absorb bumps, jolts. Oversize engine, machined steel drum tracks and Man-Ten Alloy Steel give longer life. Also built in 7S size.

Send for New Catalog, Prices, Terms

THE JAEGER MACHINE COMPANY
701 Dublin Ave., Columbus, Ohio

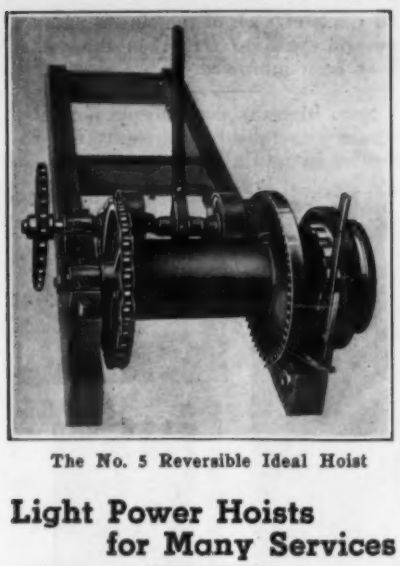
BLAW-KNOX *Finish-Spreaders*

KNOW MORE ABOUT THIS SIMPLE, LOW COST ROAD BUILDING UNIT

The Blaw-Know ROAD FINISH-SPREADER will spread and finish stone or gravel; hot or cold asphalt—one to fifteen feet wide—half a road at a time. Will lay varying widths on curves fully or partially banked—*with one machine at a fraction of the usual cost.* (Ask Blaw-Knox to send you Catalog No. 1523—"The Blaw-Knox Road Finish-Spreader."

BLAW-KNOX COMPANY, 2067 FARMERS BANK BLDG., PITTSBURGH, PA.
Offices and Representatives in Principal Cities

for Economical Bituminous Paving



The No. 5 Reversible Ideal Hoist

Light Power Hoists for Many Services

There are many jobs on which a contractor does not want to place a heavy-duty hoist because the job simply does not call for it. On locations like this, there are two hoists of 1,200 and 2,000-pounds lifting capacity with 9-inch drums 16 inches long, made by the Universal Hoist & Mfg. Co., Cedar Falls, Iowa, which fill the bill. These hoists are mounted on a wood frame 8 feet long and 27 inches wide or on a short frame which is 2 feet 6 inches long without extension for attaching the engine.

The feature of these hoists is simplicity to insure a long-lived fool-proof machine. The friction clutches are of the expanding internal ring type lined with renewable compressed asbestos and easily accessible adjusting screws provided for taking up wear. For connection to the engine either a sprocket chain or belt drive is used. Ten feet of drive chain and driving sprocket wheels to connect to the engine shaft or belt pulley up to 22 inches in diameter are furnished with the hoist without extra charge.

Ideal hoists are made with a reversible or non-reversible drum and as double drum units made up of any two of the single drum hoists.

Road Conditioner for Use with Grader or Scraper

The Beach road conditioner which fits on any grader blade or truck spring scraper is designed for leveling and maintenance work. This unit, which is made by the Beach Mfg. Co., Charlotte, Mich., consists of a moldboard to which are fastened ten individual reversible cutting blades which is attached to the grader blade, and a leveling blade attached to the back of the grader blade to smooth off the surface of the road.

When this road conditioner is used on a grader, the earth or gravel passes between the short cutting blades, leaving the material in small parallel ridges which the leveling blade smooths off. When used with a truck spring scraper, the flat moldboard is removed and the moldboard of the road conditioner attached in its place.

The cutting blades are punched in the center so that they are reversible, making it possible to wear off as much as 2 inches, then reverse the blade and wear off 2 inches on the other side. There are three holes in the center, the end holes being countersunk on the back and fit over projecting lugs on the steel castings. In the center hole is a ¾-inch bolt which holds them rigidly in place. To remove a blade, it is necessary to remove only one bolt. The springs on the leveling blade are adjustable so the pressure can be varied as desired.

Spring Cleaning Along Roads with Weed Burners

Spring is a very effective time to get rid of the weeds along the roadsides, before undesirable vegetation has had a chance to become too thick and difficult to eliminate.

The Littleford weed burner, made by Littleford Bros., 485 E. Pearl St., Cincinnati, Ohio, is a portable unit designed to handle this type of work easily and efficiently. The burner unit is equipped with a long wooden handle with a shoulder strap, enabling the operator to handle the burner with very little effort. It is also equipped with a rocker bottom which allows the burner to be placed on the ground and moved up and down as the weeds are burned.

The tank carrier for the oil drum is optional equipment, but makes it possible to move the whole outfit along the road easily and quickly as the burning operations progress.

LB weed burners come in four models, two units with one torch and two with two torches. The capacity of the fuel tank ranges from 10 to 20 gallons, and the fuel consumption per hour from 2 to 5 gallons. All four models have a 12-foot hose.

Complete information on these weed burner units may be found in Bulletin I-10 which state and county highway officials may secure gratis by writing direct to the manufacturer.

It Will Pay You To INVESTIGATE

MALL CONCRETE VIBRATORS

GAS ENGINE **ELECTRIC**

They cut labor and cement costs, produce stronger concrete without honeycombs or voids, and eliminate expensive patching. In labor saving alone, a MALL will pay for itself on a small job.
Write for bulletins . . . and let us advise you regarding the proper MALL unit for YOUR work.

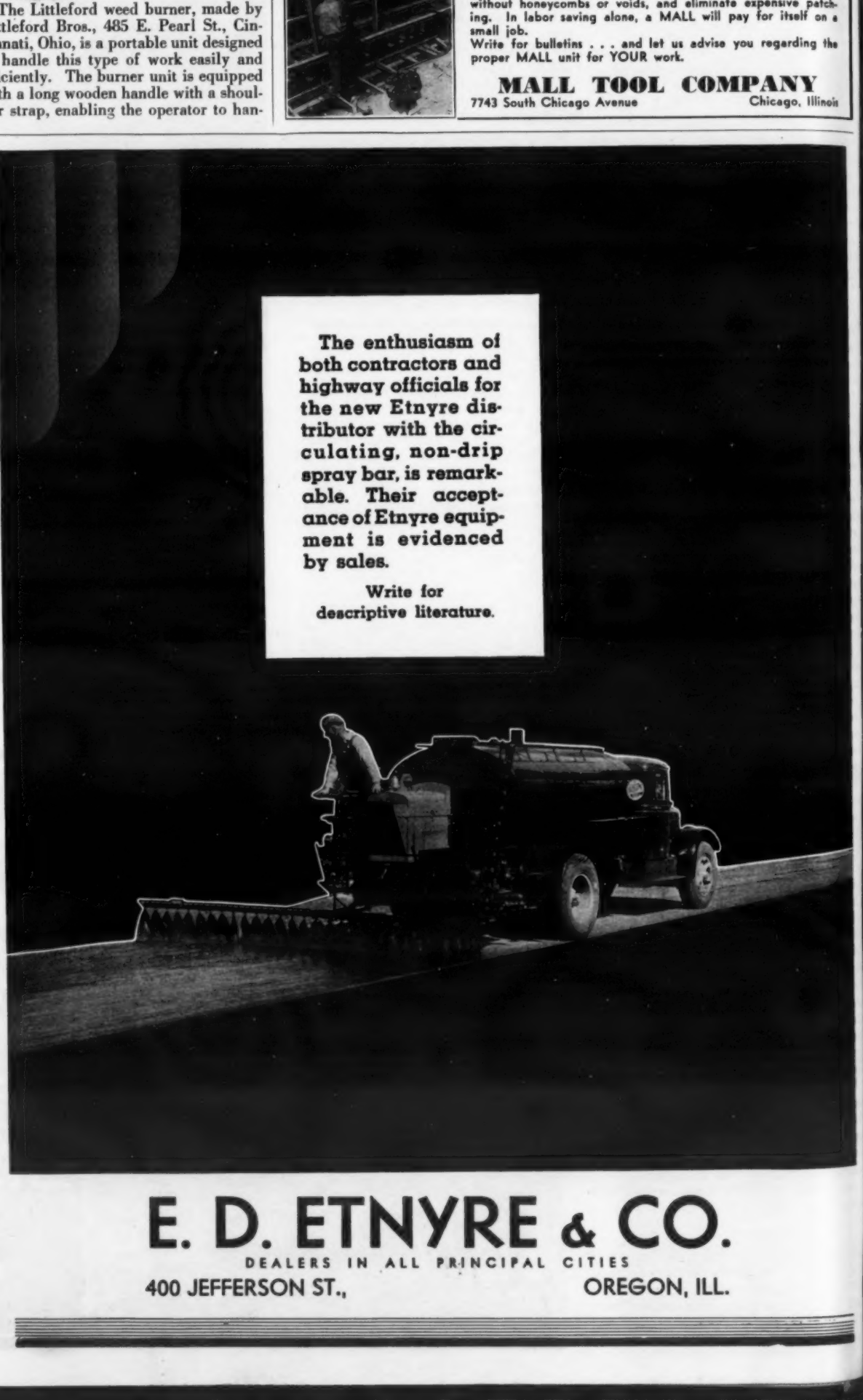
MALL TOOL COMPANY
7743 South Chicago Avenue Chicago, Illinois

Buy New Pumps at Reduced Prices

New Goulds Centrifugal Pumps

2—Type 3600—6"—Single Stage—Single Suction Centrifugal Pumps—Full Diameter Impeller. Less Base and Coupling.
Serial No. 144360
147380
Price, f.o.b. Muskegon.....$95.00 each
1—Type 3600—5"—Same specifications as above. Serial No. 135172
Price, f.o.b. Muskegon.....$85.00 each
Terms: ⅓ cash with order—balance sight draft against bill of lading.

LAKESHORE CORPORATION
Distributors
Machinery, Supplies, Contractors' Equipment
1922 Peck Street Muskegon, Michigan


The enthusiasm of both contractors and highway officials for the new Etnyre distributor with the circulating, non-drip spray bar, is remarkable. Their acceptance of Etnyre equipment is evidenced by sales.
Write for descriptive literature.

E. D. ETNYRE & CO.
DEALERS IN ALL PRINCIPAL CITIES
400 JEFFERSON ST., OREGON, ILL.

Pier Straightening by Unique Method

(Continued from page 1)

crete, anchored to the original pier at the bottom, will make in effect a much enlarged pier and after it is in place the remainder of the excavation will be filled with earth.

How Work Was Actually Done

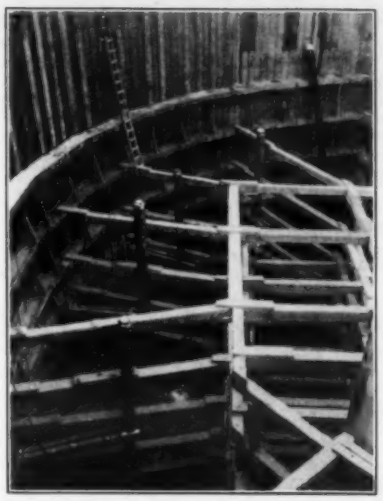
Actual construction work varied somewhat from the original plan, due to circumstances. Everything was ready to start January 1, which was before delivery could be had on the 52 Watson-Stillman hydraulic jacks. Therefore the Carnegie M-13 section steel sheet piling was driven and excavation made to the depth of the first five rings without employing them. There were 385 tons of piling in 40-foot lengths, 16 inches wide, weighing 37.3 pounds per foot required for the job. For the rings 550 tons of 36-inch I-beams were used, the weight varying from 132 pounds per foot at the top to 230 pounds per foot at the bottom rings.

Two Lincoln shielded-arc, one Lincoln stable arc, one General Electric and one P & H-Hansen gas-driven welding machines, all of 300-ampere capacity, were used for welding the rings. Approximately 5 tons of welding rod, mostly Wilson 98 3/16-inch for the vertical and overhead welding and Wilson 98 ¼-inch for the lateral welding, and a quantity of Fleetweld Nos. 5, 6 and 7, went into the job.

In starting the work, ring No. 2, second from the top, was carefully leveled up on the surface of the ground and welded. Then ring No. 1 was similarly made and blocked above it, lining the two up carefully so that they acted as a guide for starting the piles right, a still higher timber guide for the piling being also erected above the two rings. The piles were then driven down to a point past the location of ring No. 3 and the excavation made down past the location of the third ring. The first two rings followed down to their permanent locations and ring No. 3 was put in place below them, all being held against the piling in their permanent locations by shoring braced against the pier. Spacing between rings was maintained by vertical timbers. Then the driving and excavation were continued, each successive ring being placed as the excavation progressed, and the piling always a few feet in advance of the excavation.

Below ring 5, quicksand was encountered, the pressure of which against the piling began to turn it inward, with a resultant loss of radius. By that time the jacks had arrived. These 6½-inch diameter by 8-inch travel jacks are of 100-tons capacity each, working under 600 pounds per square inch oil pressure furnished by two electrically-driven pumps placed in the hole. A double extra heavy ¾-inch steel header pipe was used, with take-offs of copper tubing connected to each jack, with individual control valves. Heavy block fittings were used throughout, together with a complete system of check valves. With the jacks on rings 6, 7, and 8 it was sought to force the segments of the rings outward sufficiently before welding to bring the piles back to vertical. But the pressure of the quicksand was so great as to resist all efforts and radius was still being lost.

At ring 9, permission was sought and granted to make an off-set of 3 feet in the radius of the caisson wall. This was at a depth of about 30 feet. Friction had brought the pile driving almost to the point of refusal. The off-set was made by building an inner ring, 9x, inside of ring 9, the former being 100 feet in diameter. A new row of piling was then started outside of ring 9x and



Interior Bracing of the Upper Ring of the Caisson

continued from there to the bottom.

As stated, the jacks were discontinued with rings 9 and 9x, though they had accomplished considerable in holding the wall and keeping it lined up to a true circle through the worst of the quicksand.

The inner row of piling was then safely driven to bedrock, as the work eventually passed through the quicksand to hardpan, and under that the material was practically dry. However, some radius continued to be lost clear to the bottom, but ample space remained for the placing of the concrete slab around the pier, which will preclude all future movement. About 25,000 cubic yards of earth was excavated.

A battery of one Gardner-Denver 170-cubic foot and two Chicago Pneumatic 220-cubic foot compressors furnished the compressed air for the job.

Considering the magnitude of the work and the fact that nothing of this nature had ever before been attempted, the progress of the Pomeroy company in bringing it up to the point of pouring the slab or "boot" around the pier in so short a time as three months is notable. Apparently there is nothing now to prevent its completion some time in May, or before this year's seasonal high water stage.

Concrete for Reinforcing Slab

The mixing and placing of the concrete is no small job itself, and the contractor erected a plant for the purpose, which was ready for the placing of the concrete for the slab by April 1. Near the top of the bank an aggregate bin with a live capacity of about 300 cubic yards was erected. Below this and about midway from the top of the bank to the pier working is the batching and mixing plant. This plant consists of a Rex 1-cubic yard mixer delivering to a metal-lined chute which carries the concrete to the work. This mixer is fed from a batching hopper into which the 3-inch, 1½-inch and ¾-inch gravel and the sand are weighed by means of a Fairbanks springless scale. The required amount of water is then added to the aggregates in the hopper, and the requisite amount of cement manually dumped to the hopper. Each batch amounts to 2,850 pounds. The cement is brought down from the cement storage house at the top of the bank in the bags, the latter coming down a metal-lined chute in an upright position and stopping directly in front of the batching hopper, so that they can be easily dumped in.

Personnel

The work is being done for the U. S. Bureau of Reclamation, F. A. Banks, Construction Engineer in Charge. J. H. Miner is Office Engineer. Charles G. Huber, General Superintendent for Pomeroy was on the job, and M. L. Tibbals was Inspector for the Bureau of Reclamation Engineers.

SAVE
● WEAR
● REPAIRS
● OIL

Pipe Line Filter

Users of compressed-air equipment pay out thousands of dollars yearly for using U-N-F-I-L-T-E-R-E-D AIR which contains billions of abrasive dust particles that grind and score and wear down the surfaces of reciprocating parts.

Don't permit dust and sand to get in its destructive work on your compressors, Diesel engines, blowers, motors and compressed-air tools.

Protectomotor Air Filters positively remove 99 9/10% of the foreign matter from the air. They not only reduce wear on moving parts 75 to 85%, but also reduce carbon deposits 60 to 70%, cut oil consumption 25%, save compressed air and muffle exhaust noises. Consequently, machines operate more efficiently and run 3 to 5 times longer before overhauling is necessary.

Protectomotor Air Filters are inexpensive to buy and cost nothing to operate. No cleaning tanks or adhesives are needed. And they can be cleaned with compressed air without removing the filtering unit.

Pipe Lines, too, should be equipped with Protectomotor Pipe Line Filters to remove water, oil, rust and scale and prevent damage to tools and products with which compressed air comes in contact.

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City..... State.....

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New developments and improvements in Blaw-Knox Construction Equipment are right in step with today's program.

With a background of years of practical experience, Blaw-Knox equipment is trustworthy. It is economical and low in maintenance. Designed to stand up under severe operating conditions, it is fitted to the job by skilled engineers. It helps immeasurably to fulfill contracts speedily and profitably.

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Offices and Representatives in Principal Cities

Bulletins and Pamphlets

For free distribution to contractors, engineers and officials. Write for the catalogs you need.

Up-To-Date Methods of Concrete Handling

691 Complete information on the Rex concrete handling equipment, including Moto-Mixers for mixing and transporting the concrete to the job, and the Pumpcrete for delivering the concrete to the forms may be secured from Chain Belt Co., 1666 West Bruce St., Milwaukee, Wis.

Complete Line of Welding Equipment

692 Complete information on the Lincoln line of arc welding equipment, including the new Lincoln SA-200 Special, may be secured upon request direct from the Lincoln Electric Co., Dept. 215, Cleveland, Ohio.

Long Line of Road Machinery

693 Galion Iron Works & Mfg. Co., Galion, Ohio will be glad to send to interested contractors and state and county highway engineers literature describing the complete line of Galion road machinery for construction and maintenance.

Heavy-Duty Dump Units

694 The Heil Co., Milwaukee, Wis., will be glad to send on request complete information on Heil heavy-duty dump units which are designed for fast, powerful and dependable service.

Portable Asphalt Plants

695 Hetherington & Berner portable asphalt plants of the tower type for hot or cold mix are described in Bulletin T-248 which Hetherington & Berner, Inc., Indianapolis, Ind., will send on request.

Spray-Painting Traffic Lines

696 The Littleford Traf-O-Spray which spray-paints traffic lines neatly, uniformly and easily on any hard surface is described in Bulletin L-9 which Littleford Bros., 485 E. Pearl St., Cincinnati, Ohio, will send on request.

Long Range Dirt Moving Machines

697 Problems of digging, conveying, stockpiling earth, clay, sand or bulk materials may be solved by the use of Sauerman long range slackline cableways and scrapers which are described in a catalog Sauerman Bros., 464 So. Clinton St., Chicago, Ill., will send on request.

Dump Bodies with Balanced Power

698 Burch dump bodies in 1½ and 2-yard capacities, a feature of which is the balanced power hoists for raising or lowering, are described in literature which may be secured from the Burch Corp., Dept. M., Crestline, Ohio.

Self-Priming Pumps

699 Novo Engine Co., 216 Porter St., Lansing, Michigan, will be glad to send complete information on its Novo self-priming centrifugal pumps in 2, 3, 4 and 6-inch sizes, with 7 to 90,000 gph capacities.

Graders for Year Round Service

700 "Caterpillar Auto Patrols, for Year Round Service" is the title of a new illustrated catalog describing the four Auto Patrol models and their use in road construction, finishing, maintenance, oil-mix, scarifying and snow removal. Copies of the catalog may be secured gratis from the Caterpillar Tractor Co., Peoria, Ill., by mentioning this magazine.

Sure Traction for Rough Going

701 Complete information on Firestone Ground Grip tires which were especially designed to provide sure traction through sand, loose gravel, mud and rough terrain, may be secured by interested contractors and engineers from the Firestone Tire & Rubber Co., Akron, Ohio.

Bins and Batching Equipment

702 A new bulletin just off the press describing the complete line of Heltzel portable and stationary bin and batching equipment may be secured by interested contractors direct from the Heltzel Steel Form & Iron Co., Warren, Ohio.

Walking Draglines for All-Weather Work

703 Complete information on Bucyrus-Monighan walking draglines which are designed to provide profitable all-weather output may be secured direct from the Bucyrus-Erie Co., South Milwaukee, Wis.

The A-C Line of Construction Equipment

704 A new pictorial catalog illustrating the various Allis-Chalmers gasoline and oil-burning tractors, leaning wheel and hand-controlled graders, speed patrols, Speed-Ace wagons, crawler tracks and power units may be secured by those interested direct from the Allis-Chalmers Mfg. Co., Tractor Div., Milwaukee, Wis.

Rock Drill Dust Control

705 This is the title of a new bulletin describing the Markley rock drill dust control system which is a simple, portable apparatus for the control of dust from rock drilling and the elimination of the serious health hazard, silicosis, which has been so much publicized of late. Copies of this bulletin may be secured gratis direct from Markley Dust Control System, Inc., 415 Lexington Ave., New York City.

A Speed Crane, Shovel and Dragline

706 The Manitowoc Speedcrane, Speedshovel and dragline, with boom lengths ranging from 45 to 100 feet and dipper capacities of from 1 to 2 cubic yards, is described fully and illustrated in a new bulletin which the Manitowoc Engineering Works, Manitowoc, Wis., will be glad to send on request.

Booklet Helps in Selection of Crushers

707 A new booklet which is designed to aid the contractor in the selection of the proper type, size and design of crusher for his jobs by giving information on the various types of crusher work and the factors which determine the type and size of crusher to select, has been issued by the Pioneer Gravel Equipment Mfg. Co., 1515 Central Ave., Minneapolis, Minn. Copies may be secured by writing direct to this company and mentioning this magazine.

Asphalt Products for Road Building

708 Complete specifications for Socony asphalt road oils, joint fillers, cut-back surfacing asphalt, binder for surface treatment and penetration macadam, and cold patch asphalt for all types of patching may be secured upon request direct from the Standard Oil of New York Div., Socony-Vacuum Oil Co., 26 Broadway, New York City.

Excavating in the Dry

709 Griffin Jet N' Drive wellpoint systems to provide dry working conditions in excavations for foundations, sewer construction, tunnels and similar work, are described in Catalog A which the Griffin Wellpoint Corp., 60 E. 42nd St., New York City will send on request.

SEND THIS BACK—WE'LL DO THE REST

CONTRACTORS and ENGINEERS MONTHLY
470 FOURTH AVE., NEW YORK

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Condensed Road Machinery Catalog

710 The new Adams road machinery catalog which gives a condensed description of the Adams line of road machinery, including the various models of leaning wheel graders, road patrols, terracers, elevating graders, retread pavers and multi-blade maintainers, may be secured by interested contractors and state and county highway engineers by writing to the J. D. Adams Co., Indianapolis, Ind., and mentioning this magazine.

Distributors for Road Building

711 The Etnyre bituminous distributor, a feature of which is the circulating non-drip spray bar, for use in the construction and maintenance of bituminous roads, is described in literature which contractors and state and county highway engineers may secure direct from E. D. Etnyre Co., 400 Jefferson St., Oregon, Ill.

Equipment for Concrete Jobs

712 Ransome Concrete Machinery Co., Dunellen, N. J., will be glad to send complete information on Ransome pavers, mixers, pneumatic concrete placers, pneumatic grouters and tower and chuting plants.

Cranes in Fifteen Sizes

713 Northwest cranes in a variety of capacities for handling steel and other materials, features of which are the throttle retard and the variable speed motor, permitting movement of fractions of inches, are described in literature which may be secured upon request from the Northwest Engineering Co., 1730 Steger Bldg., 28 E. Jackson Blvd., Chicago, Ill.

Hauling, Dumping and Spreading Unit

714 Koehring Co., 3026 W. Concordia Ave., Milwaukee, Wis., will be glad to send to interested contractors complete information on the Koehring Dumptor for hauling, dumping and spreading dirt.

Drill Rigs for Tough Drilling Jobs

715 Bulletin 111 describing the Cleveland DR6 Universal drill rig which is particularly designed for the extra tough drilling job may be secured by interested contractors from the Cleveland Rock Drill Co., 3734 E. 78th St., Cleveland, Ohio.

One-Man Wagon Scrapers

716 Complete information and user reports on Continental wagon scrapers, the action of which is entirely controlled by the tractor operator, and which are made in 5 and 7-yard sizes, may be secured by interested contractors from the Continental Roll & Steel Foundry Co., Tractor Equipment Div., 332 So. Michigan Ave., Chicago, Ill.

Air-Operated Vibrators

717 Literature and engineering data on Munsell air-operated vibrators for all classes of concrete construction may be secured by interested contractors and engineers from Munsell Concrete Vibrators, 997 West Side Ave., Jersey City, N. J.

Information on Low Cost Roads

718 The Technical Service Bureau of the Barrett Co., 40 Rector St., New York City, invites the consultation of state and county highway engineers on their road problems, without cost or obligation.

2 to 8-Inch Self-Priming Pumps

719 Sterling dependable 2 to 8-inch self-priming pumps are described in literature which the Sterling Machinery Corp., 411-15 Southwest Blvd., Kansas City, Mo., will be glad to send on request.

Repair Equipment by Welding

720 Copies of the booklet "The Many Profitable Uses of Simplified Arc Welding" may be secured by contractors and state and county highway engineers by writing direct to Hobart Bros., Box CE-46, Troy, Ohio.

Crusher Produces Cubical Aggregates

721 The Telsmith Gyrasphere crusher which produces a cubical aggregate which is claimed to make a stronger concrete and a better road material, is described in Bulletin Y-34 which may be secured upon request from the Smith Engineering Works, 4014 N. Holton St., Milwaukee, Wis.

Three-Axle Tandem Rollers

722 The Buffalo-Springfield three-axle tandem roller for use in road construction and maintenance is described in an illustrated circular which the Buffalo-Springfield Roller Co., Springfield, Ohio, will send on request.

Two-Stage Portable Air Compressors

723 I-R two-stage air-cooled portable air compressors in a variety of sizes are described in Catalog 3164 which the Ingersoll-Rand Co., 11 Broadway, New York City will be glad to send on request.

Trailers, Large and Small

724 Rogers heavy-duty trailers, in models to suit the requirements of equipment moving of all types are described in Catalog 633 which Rogers Bros. Corp., Albion, Pa., will send on request.

Air Filters for Compressed Air Equipment

725 Copies of the catalog describing and illustrating the Staynew Protectomotor air filter for cleaning the air used in compressed air equipment, which is claimed to save wear, repair bills, and oil, and also the intake filter for cleaning the air for internal combustion engines may be secured by those interested from the Staynew Filter Corp., 17 Leighton Ave., Rochester, N.Y.

All-Weather Signal Torches

726 Storm King signal torches which have a number of features and which are claimed to burn brightly and evenly in a 68-mile an hour gale are described in literature which the Shanklin Mfg. Co., Springfield, Ill., will send on request to interested contractors, state and county highway engineers.

Death and Damage Greater Because Road Rules Vary

Death on the highways could be decreased if road and traffic officials put into effect generally those regulations of proved value which have already been widely adopted. The mere lack of uniformity in traffic regulation, says Thomas H. MacDonald, Chief of the U. S. Bureau of Public Roads, is the cause of many accidents.

The National Conference on Street and Highway Safety has prepared model motor vehicle codes and traffic ordinances. This work, says MacDonald, was done by leaders in the various fields. Although thirty-nine states have adopted the proposals in part, only a third of the states are in reasonably close agreement with the code.

Licensing of drivers only after a thorough examination is recognized by all traffic authorities as essential for accident prevention. Only nineteen states have the standard licensing system provided by the uniform vehicle code, which provides a strong central state organization to control the issuance of drivers' licenses and also the machinery for following up repeated violations of law and for revoking licenses. Revoking the licenses of dangerous drivers has been found highly effective where this policy has been put into effect vigorously.

Standards for highway signs, signals, and road markings have been prepared through the cooperation of national organizations and have been widely adopted. The occasional departure from standard practice in locating traffic lights and warning signs is all the more dangerous because drivers have become accustomed to standard practice.

Vigorous enforcement of laws is admitted to be necessary, yet the Bureau of Public Roads has found by checking several hundred thousand drivers that half of the drivers do not fully observe stop signs, 7 per cent drive to the left of the center line, nearly 4 per cent pass other vehicles on hills and 1.5 per cent pass other vehicles on curves.

TENTS
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WINDBREAKS

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MINNEAPOLIS BROOKLYN NEW ORLEANS KANSAS CITY, KAN.

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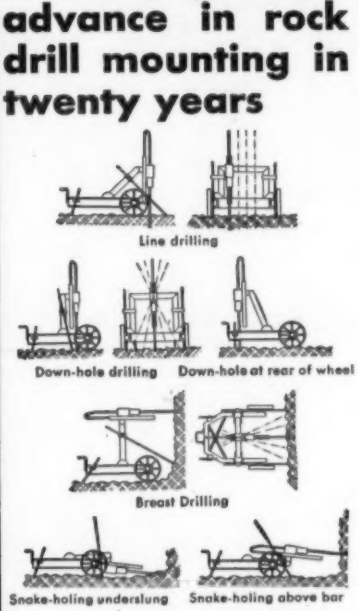

A few of the many positions in which the Rock Master can be used

- Can be set anywhere, to drill in any direction
- Three men can move it over roughest ground
- Speeds up drilling . . . cuts costs

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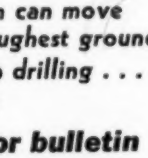

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Contractors and Engineers Monthly

Operation Problems of This Cableway over Bonneville Spillway Dam Are Solved by Experiments with a Toy-Size Model. See Page 15.

A Strip Act But Not Burlesque! A 12-Yard Scraper Removing Overburden of Weeds, Matted Roots and Stumps at Piedmont Dam, Ohio. See Page 19.

Right—Indiana Limestone Designed Not for a Post Office But for a Highway Fill on the Calumet Paving Co. Grading Contract Which Involved 80,000 Yards of Rock Excavation near Bedford, Ind. See Page 7.

Left—Cranes Setting 50-Foot Steel Sheet Piling Along the 20-Foot Railroad Embankment on Contract No. 3 of the New Camden Subway Approach to the Delaware River Bridge. Below—Close-Up of Movable Timber Frames for Guiding Sheet Piling, Used by Triest Contracting Co. See Page 2.

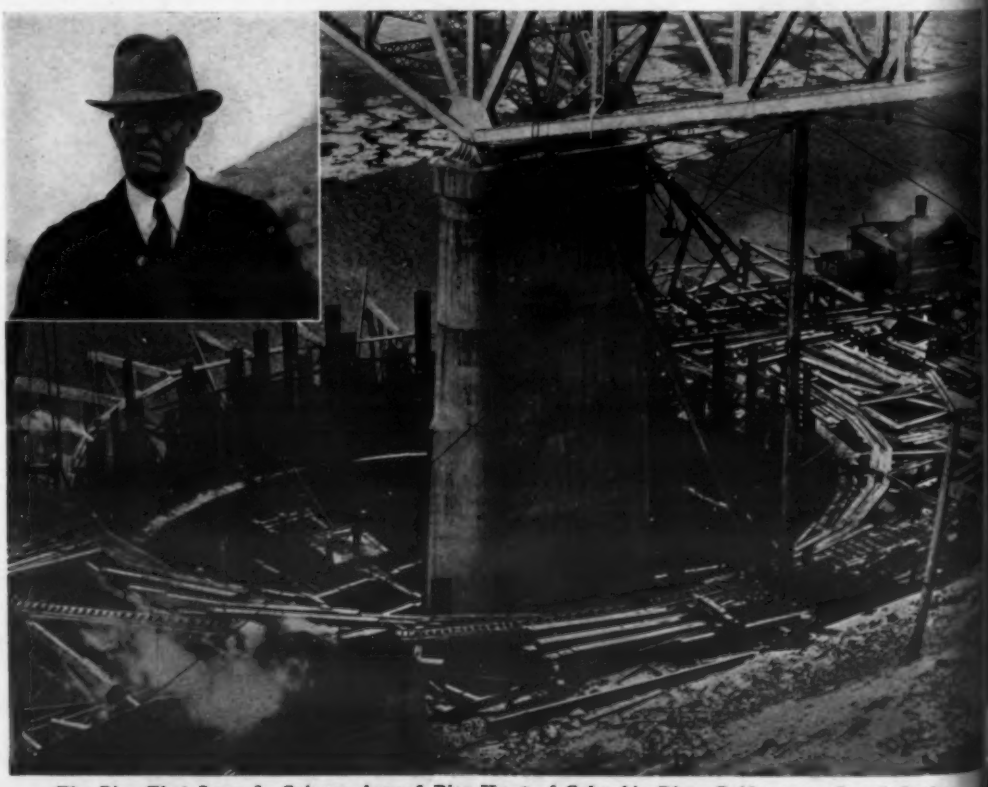
C. & E. M. Photo

C. & E. M. Photo

High and Dry, Awaiting Both Creek and Road. A Typical Secondary Road Bridge near Stella, Nebr. See Page 2.

C. & E. M. Photo

A Facial for a 60-Foot Vertical Earth Cut on the Shirley Constr. Co. Contract for the New By-Pass around Council Bluffs, Iowa. This Unusually Deep Sidehill Cut Was Made in Only Two Lifts by a 1¼-Yard Shovel Casting a Portion of the Material and Loading the Remainder to Four to Eleven Crawler Wagons. See Page 25.



The Pier That Leaned. Caisson Around Pier No. 2 of Columbia River Bridge near Grand Coulee. Insert, Chas. G. Huber, Supt. for J. H. Pomeroy, Inc., Which Straightened the Pier. See Page 1.